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"[Duhamel's] book no doubt played a large part in stimulating interest in the drill husbandry, which had fallen into abeyance soon after Tull's death." —Fussell II, p. 48.

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1757 LONDON

A PRACTICAL TREATISE OF HUSBANDRY:

Wherein are contained, many

USEFUL and VALUABLE

EXPERIMENTS and OBSERVATIONS

IN THE

NEW HUSBANDRY,

Collected during a SERIES of YEARS, by the Celebrated

M. DUHAMEL DU MONCEAU,

Member of the Royal Academy of Sciences at Paris, Fellow of the Royal Society, London, &c.

ALSO,

The most approved Practice of the best ENGLISH FARMERS, in the OLD METHOD of HUSBANDRY.

WITH

COPPER-PLATES of several new and useful INSTRUMENTS.

Agricola incurvo terram dimovet aratro.
Hinc anni labor; hinc patriam, parvosque nepotes
Sustinet; hinc armenta boum, meritosque juvencos.

VIRG. Georg. l. 2.

LONDON:

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MDCCLIX.

To The Right Honourable

J A C O B,

Lord Viſcount

F O L K E S T O N E,

P R E S I D E N T;

The Right Hon. *Robert*, Lord *Romney*,
The Right Hon. *George Henry*, Earl of *Litchfield*,
The Right Hon. *Simon*, Earl of *Harcourt*,
The Right Hon. *Hugh*, Lord *Willoughby*, of *Parham*,
The Rev. *Stephen Hales*, D. D.
Charles Whitworth, Eſq;
Edward Hooper, Eſq;
George Eckerſall, Eſq;

VICE-PRESIDENTS;

And to the reſt of the Gentlemen, who are of the Society for the Encouragement of Arts, Manufactures and Commerce;

This practical Treatiſe of Huſbandry, is inſcribed, with the utmoſt Reſpect,

By Their moſt obedient Servant,
And Sincere Wellwiſher,

John Mills.

March 24,
1759.

PREFACE.

M. DUHAMEL and his correſpondents have ſet the world an example which has long been wanted, and greatly deſired by all who have the good of their country at heart, and are in the leaſt ſenſible of the importance of Agriculture. They have given us a ſeries of experiments in this moſt uſeful art, continued for ſeveral years together, with accuracy and judgment, and related in a clear, diſtinct, manner. Theory alone can avail but little in Agriculture, which, as Dr. Home obſerves, " does not take its riſe originally from reaſon, " but from fact and experience. It is a branch of natural philoſo- " phy, and can only be improved from a knowledge of facts, as " they happen in nature. It is by attending to theſe facts that the " other branches of natural philoſophy have been ſo much advanced " during theſe two laſt ages. Medicine has attained its preſent per- " fection, only from the hiſtory of diſeaſes and caſes delivered " down. Chymiſtry is now reduced to a regular ſyſtem, by the " means of experiments made either by chance or deſign. But " where," continues he, " are the experiments in Agriculture to " anſwer this purpoſe ? When I look round for ſuch, I can find " few or none. There then lies the impediment in the way of " Agriculture. Books in that art, we are not deficient in : but the " book which we want, is a book of experiments."

After

After writing this, the Doctor read the three firft volumes of Experiments publifhed by M. Duhamel, and gives them the following character.* "They are," fays he, "diftinct, exact, conclu-"five fo far as they have gone, and ftand a model for experiments "in Agriculture. What a fhame," adds he, "for Great Britain, "where Agriculture is fo much cultivated, to leave its exact value "to be determined by foreigners!"

The 4th and 5th volumes of M. Duhamel's work, which contain the greateft part of the truly valuable experiments of M. de Chateau-vieux, deferve ftill higher commendation, and may yet more juftly be propofed as models, not only for their accuracy and fuccefs, but alfo on account of the variety of plants which he has cultivated according to the principles of the new hufbandry.

The Reverend and worthy Dr. Stephen Hales, whofe name does honour to his country, and whofe ftudies have always been directed to the improvement of it, as well as to the general benefit of mankind, has given us leave to fay of M. Duhamel's work, (which was fent to Dr. Hales as a prefent by the author,) "that the Englifh rea-"der will find therein many ufeful inftructions and hints for far-"ther improvements in hufbandry."

As M. Duhamel's five volumes were publifhed in different years, he could not give an uninterrupted account of each experiment, from its beginning; efpecially as they were made by different perfons, and in different places: nor could he well avoid frequently repeating, or, at leaft, refuming, the heads of what had been faid before; by which means their progrefs towards perfection is not fo obvious to the reader, as the writer of this work hopes they will appear, when ranged in the more methodical order he has endeavoured to give them. Another reafon which has induced him to give each different experiment from its very beginning, is, that he might fhew the difficulties which occurred at firft, and how they were afterwards got over. He has tranflated only fuch experiments as feemed to him to carry with them a variety which may be inftructive to his country-men:

* In his Principles of Agriculture and Vegetation.

men: and to render this treatiſe the more uſeful, he has given what appeared to him beſt in the modern practice of farming, either according to the old or new method. The plainneſs wherewith it is written, will ſhew, that his intention was to make it of as general uſe as poſſible.

Every one who contributes to the public good, deſerves applauſe; and conſequently it is due to all M. Duhamel's correſpondents. But the obligations of the public, to the two gentlemen to whom we are indebted for moſt of the following experiments, are ſtill increaſed, when we conſider the unwearied diligence with which they purſued a ſubject of ſo different a nature from that of their reſpective employments. The poſt of Inſpector-general of the Marine of France, would, alone, have given ſufficient exerciſe to a genius leſs active than M. Duhamel's, and not allowed opportunity for his ſteady and ſucceſsful application to this and every other branch of natural philoſophy. 'Tis true, the neceſſary attendance on the diſcharge of his more immediate buſineſs, prevented him from purſuing his experiments in Agriculture, ſo far as he doubtleſs would otherwiſe have done, and from making them in that number and variety which the ſubject required: but we owe to his efforts and example, the zeal with which others have been animated in their experiments: and, above all, we are indebted to him for the excellent inſtructions we have received from M. de Chateau-vieux, who, even whilſt he held the firſt Office in the City and Republic of Geneva, found time to apply himſelf with ſurprizing attention to this important object; and that too at an age which generally carries with it a diſpenſation from the cares and ſervice of the public, to thoſe who have leſs zeal for the intereſt of it. The variety of his experiments, and the remarkably judicious obſervations which he makes upon them, ſhew him to be poſſeſſed of the moſt extenſive knowledge of this ſubject.

Such are the laudable examples of two foreigners, for the advancement of Agriculture. How far their countrymen may have profited by them, is not to our preſent purpoſe to examine: we propoſe them to our own, and we hope not unſucceſsfully. This kingdom has indeed produced ſome inſtances of the ſame kind. The late Lord Townſhend thought Agriculture to be an object well worthy

worthy of his attention, and actually introduced the ufe of marle, and the hufbandry now followed in the county of Norfolk, which, to this day, is greatly indebted to him for fo valuable an improvement: and furely nothing could more become his Lordfhip, than thus to dignify his retirement, by making it ufeful to the public.

The misfortune however is, that the fuccefs of thefe generous attempts of individuals, of whatever rank, is generally but too much limited; often within the bounds of a county, or two at moft: for the common farmer is perhaps the leaft inquifitive of any man, after improvements in his own bufinefs; is frequently the moft obftinately attached to the practice of his predeceffors; and often too, we muft allow, it might not confift with prudence for him to rifque his little competence, upon the fuccefs of experiments.

But we promife ourfelves, that it will be the happinefs of the prefent age to fee every obftacle removed, which might retard a general improvement in Hufbandry, the genuine and original fource of the wealth and power of this Ifland, as well as of its ornament and fecurity.

The Society for the encouragement of Arts, Manufactures, and Commerce, have taken This under Their peculiar care: and what may we not expect from a Society, the Members whereof are fo well qualified to direct and improve the moft ufeful inquiries; and who generoufly diftribute their private bounties, to reward the labour, and indemnify the charge, of fuch experiments, as tend to promote any ufeful knowledge, or national advantage!

To return to the work before us. It is divided into four parts. The firft contains the general principles of Agriculture, together with the moft approved practice in the old hufbandry; in which the reafoning of Mr. Evelyn is chiefly followed, as the moft rational that has hitherto appeared, though undefervedly neglected by our writers on Agriculture. It is a misfortune to practical farmers, that his excellent *Difcourfe of Earth*, for want of having been oftener printed feparate from his other works, has not been fo well known

to

to them, as a performance of that great merit deserves. Dr. Home's ingenious *Treatise on the Principles of Agriculture*, &c. deserves commendation; but it is not yet rendered sufficiently practical, to be of general use to farmers. The essential differences between the old and new husbandry, are pointed out and explained in this first part.

The second, is confined to the culture of wheat, according to the principles of the new husbandry, the superior advantage of which is proved by a series of many experiments.

In the third part, the new husbandry is applied to the culture of other plants useful to the farmer.

That the descriptions of the several instruments used in the new husbandry, might not interrupt the detail of the experiments, these descriptions are given in the fourth part, together with the Plates wherein those instruments are represented.

ADVERTISEMENT.

AS the French measures are retained in the parts of this work taken from M. Duhamel, it is proper to observe, that, supposing the English foot in *Guildhall* to be 1000, and the Paris foot in the *Chatelet* 1068, which is M. Greaves's calculation of their difference; the French *arpent*, consisting of 100 perches of 22 feet each, making in all 48400 square French feet, is equal to 51691 English square feet, or to 1 acre, 29 poles, 9 paces, 1 yard, and 2 $\frac{3}{4}$ square feet, that is to say, to very near an acre and three quarters of a rood English measure.

The French *bushel*, consisting of 4 *quarters*, and the quarter of 4 *litrons* of 36 Paris cubic inches each, contains 576 French cubic inches, which, in the above proportion, are equal to $615\frac{368}{1000}$ English inches: and consequently the French bushel is to the English, as $615\frac{368}{1000}$ to 2178, the number of cubic inches in the English bushel: or, in other words, it is equal to one peck, 1 quart, and nearly 2 cubic inches.

The French bushel for oats, is double that of any other grain.

The *Septier* contains 12 French bushels.

These may, perhaps, not be the exact mathematical proportions between the English and French measures, were their standard to be precisely ascertained, which it is not: but, at least, they are near enough to the proportions of the measures commonly used in both countries, to answer all the ends they are intended for in this work.

CON-

CONTENTS.

PART I.

CHAP. VIII.

CHAP. IX.

CHAP. X.

CHAP. XI.

CHAP. XII.

CHAP. XIII.

CHAP. XIV.

CHAP. XV.

CHAP.

CHAP. XVI.

CHAP. XVII.

CHAP. XVIII.

PART II.

EXPERIMENTS *and* REFLECTIONS *relative to the* NEW HUSBANDRY.

CHAP. I.

§. II.

CHAP. II.

Ex-

Expe-

Art.

PART. III.

Of the Culture of SPRING CORN, MILLET, *and* RICE, LEGUMINOUS PLANTS *and* POT-HERBS, FLAX *and* HEMP, ARTIFICIAL *and* NATURAL GRASS, *and the* VINE.

CHAP.

CHAP. II.

CHAP. III.

CHAP. IV.

CHAP. V.

CHAP. VI.

CHAP. VII.

CHAP. VIII.

CHAP. IX.

Account

CHAP. X.

CHAP. XI.

CHAP. XII.

PART

PART IV.

Of the INSTRUMENTS *peculiar to, or useful in, the* NEW HUSBANDRY.

CHAP. I.

CHAP. II.

CHAP. III.

CHAP.

CHAP. IV.

CHAP. V.

A PRAC-

A PRACTICAL TREATISE OF HUSBANDRY.

PART I.

CHAP. I.

Of ROOTS.

AS the culture which is beſtowed upon the productions of the earth, acts principally upon the roots, and relates more immediately to them, than to any other part of plants, we make them the ſubject of our firſt chapter. The nice diſtinctions by which botaniſts characteriſe certain kinds of plants, would be foreign to our purpoſe in this work, the ſole deſign of which is to treat of agriculture. We ſhall therefore content ourſelves with dividing the roots of plants in general into two ſorts, *viz. carrot* or *tap-*

roots, and *creeping* or *fibrous-roots*. The former, which are generally ſingle, run down almoſt perpendicularly into the earth, and the latter branch out horizontally, whence they are likewiſe called *horizontal-roots*.

The Roots which proceed immediately from the ſeed, are always of the carrot or tap kind. They ſtrike down perpendicularly into the earth, 'till it becomes too hard to admit of their farther paſſage: but when the ſoil is deep, and eaſily pierced, they penetrate ſometimes to the depth of ſeveral yards, unleſs they are cut or broken, in which caſe they alter their direction. This I have frequently had occaſion to obſerve; particularly in plants raiſed in water only. The tap-roots ſhoot out branches which extend horizontally; and theſe branches are ſtronger, in proportion as they are nearer to the ſurface of that depth of earth which is ſtirred by the plough or ſpade.

Theſe are the roots which we call creeping, or fibrous. They extend ſometimes to a conſiderable diſtance from the plant that produces them: but then they become ſo minute, that the naked eye can no longer trace them; eſpecially when they have taken the tincture of the earth that ſurrounds them, as they generally do.

A Carrot, for example, which ſeems to have only one great root furniſhed with ſome fibres, puſhes its roots, according to Mr. Tull, to a conſiderable diſtance: but they grow ſo very ſlender, that they cannot be diſtinguiſhed from the earth that covers them, without great attention. The caſe is the ſame with almoſt all plants. To be convinced of this, and at the ſame time to know how far the roots of any plant can extend in ground that has been well looſened by the plough or ſpade, one need only make the following, or ſome other ſimilar experiment.

Take a piece of ground that has not been broken up for a long time, and dig in it a triangular ſpot, 80 feet long, 12 feet wide at one end, and ending in a point at the other. Sow 20 turneps in the length of this ſpot, and let the earth round them be frequently dug and well hoed. When the turneps are come to their full growth, if that which is next the point is found to be the ſmalleſt, and the others are gradually bigger as they ſtand nearer to the part of the triangle, that is, for inſtance, four feet wide, it may be concluded that the roots of thoſe bigger turneps have ſpread two feet on every ſide: and if the turneps are nearly of the ſame ſize from thence to the wideſt end of the triangle, it will be reaſonable to ſuppoſe that their roots have not extended above two feet.

The

The following inſtances ſhew what efforts trees will make, to find a proper ſoil for the extenſion of their roots.

On examining thoſe of a hedge, at the ſide of which a ditch had been dug, it appeared, that after paſſing underneath the ditch, they re-aſcended, and ſpread themſelves in the plowed earth on the other ſide.

I made the ſame obſervation on a row of elms, which were very near being killed by the digging of a deep ditch pretty near them, in order to prevent their roots from damaging an adjacent piece of ground. The elms ſhot out freſh roots in the looſe mould that dropt into the ditch: theſe roots re-aſcended on the other ſide of the ditch, and ſpread in the plowed ground, and the elms ſoon recovered their former vigour.

I have likewiſe obſerved, that on digging a trench at a ſmall diſtance from a young elm, and filling it with good mould, the roots of that elm took their direction towards the trench, and grew to a great length in it.

Mr. Duhamel, gives an inſtance of two elms blown down by the wind, which had ſtood upwards of an hundred years, whoſe original roots, being planted too deep, had not increaſed in all that time, but the trees had been fed by other roots which ſhot out nearer the ſurface of the earth.

Theſe obſervations prove that roots extend themſelves to a great diſtance in the earth, eſpecially when the mould is looſe: and as a plant thrives in proportion to the extent of its roots, Mr. Tull juſtly infers the neceſſity of keeping the earth in a light ſtate.

A root that has been cut or broken, never grows longer, but ſoon produces ſeveral new roots, all of which gather the proper food of the plant. Its means of ſubſiſtence are therefore increaſed by the breaking of its roots in digging or plowing.

CHAP. II.
Of LEAVES.

LEAVES are ſo neceſſary to plants, that few can ſubſiſt without them: for experience ſhews, that if they are ſtrip'd of all their leaves, they generally die. I ſay generally, becauſe we ſometimes ſee trees ſtrip'd by inſects, which do not die. But I have killed trees by taking off all their leaves. Is this difference owing to the inſects deſtroying them by degrees, or to my pulling them off all at once? Or is there any particular ſtate of plants, in which this total ſtripping of them is not of ſo fatal conſequence?

The experiments of Mr. Mariotte, Dr. Woodward, and Dr. Hales, prove that the leaves are the organs of perſpiration in plants; and that the greateſt part of the ſap goes off that way. The reſt is ſpent in the increaſe of the plant. We likewiſe know that the leaves imbibe the moiſture of rain and dew; which greatly promotes the growth of the plant.

In what manner leaves may be immediate organs of the perſpiration of plants, or of the preparation of the ſap, would be foreign to our purpoſe to inquire into: but that they are organs highly uſeful, appears from the following experiments.

If half, or two thirds of the leaves of a young tree in full ſap are ſtript off, the tree loſes its ſap in two or three days. The bark, which before ſeparated eaſily from the wood, then adheres cloſely to it. Before the leaves were ſtript off, the tree might be grafted by a ſcutcheon; but the next day, the bud cannot be inſerted. The tree is therefore weakened by the loſs of its leaves.

A willow, a poplar, an elm, that is ſuffered to grow without being lopped, will remain an age ſound in the trunk: on the contrary, when turned to pollards, the trunk ſoon grows rotten. The repeated lopping of the branches is therefore very prejudicial.

The fine ſhort graſs which covers the lawns of England, is the only plant that can bear frequent cloſe mowing or eating. This grows the more beautiful for it; but all others are killed thereby.

What we have ſaid ſhews that leaves, in whatever light they are conſidered, are of the greateſt advantage to plants: and conſequently that ſain-foin, luſerne, clover, &c. are greatly hurt when they are fed too cloſe by cattle, eſpecially when young. We cannot therefore approve the practice of farmers, who turn in their flocks to feed on their wheat when it is too rank. This we ſhall have occaſion to ſpeak more fully of hereafter.

CHAP. III.

Of the Food of PLANTS.

SALT, air, fire, water, and earth, form, perhaps, the food of plants. But without entering into that detail, we may, with Mr. Tull, conſider earth reduced to very minute particles, as the chief part of that food, ſeeing that plants become earth by putrefaction;

tion; and the other principles ſerve, perhaps, only to render earth fit for the nouriſhment of plants.

Salt, for example, may attenuate earth, water may enlarge its particles, and air and fire give it a due motion and activity: but earth ſeems to be the eſſential part. The plant would indeed die, if deprived of the other elements: but without earth, not even a ſkeleton of it would remain.

The earth we are ſpeaking of, is not a ſimple elementary earth, or *caput mortuum*; for all the principles we have mentioned, may be extracted from the dead plants. It may hence be admitted, that earth is the principal food of plants: eſpecially as it is known, that too great a quantity of ſalt renders earth barren; too much water drowns and rots plants, too much air dries up their roots if expoſed to it, and too much heat (or fire) burns them. But plants are not hurt by too much earth: for if a plant languiſhes when its roots are buried too deep, it ought not to be imputed to the quantity of earth that covers thoſe roots, but to its not enjoying the moiſture of the dew, the warmth of the ſun, the influences of the air, &c.

But it is not the deſign of a Treatiſe of Agriculture, to enter into the diſcuſſion of ſo difficult a queſtion as what is the real food of plants. We ſhall therefore, with Mr. Tull, conſider earth greatly attenuated, as the immediate food of plants, without deciding whether it be ſimple, elementary, and void of all other ſubſtance.

Of whatever nature the ſubſtance which nouriſhes plants may be, we ſhall examine in the next chapter whether it be nearly the ſame for different kinds of plants.

CHAP. IV.

Whether the moſt different kinds of Plants draw the ſame ſort of ſubſtance from the earth, for their Food.

IT is generally thought that each different ſpecies of plants is fed by different juices. The chief arguments for and againſt this opinion, are as follows.

1. It does not ſeem probable, ſay thoſe who are for it, that the ſame homogeneous matter can be the food of ſo many plants, which differ ſo widely from each other in their ſhape, colour, taſte, and properties.

To this it is anſwered; that there is no doubt but that the particles which plants appropriate to themſelves, take different forms in each plant: but it does not at all follow, that they were not the ſame in the earth.

What would induce me to think them the ſame, is, that plants rob one another, if I may ſo ſay, of the nouriſhment that is in the earth. For, if a lettice, for example, drew from the earth a food different from that of endive, a lettice planted among endive would not only thrive better than if planted among other lettice, but as well as if no other plant was near it: but we know by experience that this lettice would thrive very poorly, and conſequently that plants, tho' of different ſpecies, do hurt and rob one another.

To prove that the ſame juice takes different qualities in the veſſels of the ſame plants, I need but mention an experiment which I made long ago. I grafted a young lemon, of the ſize of a pea, by the ſtalk, upon the branch of an orange-tree. It grew there, ripened, and retained its quality of lemon, without partaking in any ſhape of that of the orange. The juices of the orange-tree muſt therefore have changed their nature at once, on their paſſing into the lemon.

2. Why is barley or oats ſown after wheat, but becauſe the wheat has drained the earth of thoſe juices only which are proper for its own ſpecies; and the juices proper for the nouriſhment of barley, or oats, ſtill remain in the earth?

The anſwer is, 1. If barley grows well after wheat, for no other reaſon than becauſe the earth has retained that kind of juice which is proper for its nouriſhment, it would follow that we might expect a good crop from wheat ſown upon barley ſtubble, becauſe the barley had not conſumed the juices fit for the nouriſhment of wheat. Yet we may be ſure the crop would be very bad; becauſe wheat never thrives well, but upon land that is in fine tilth. If barley was to be ſowed in land in as good condition, we ſhould be more certain of an excellent crop. But as barley is leſs valuable than wheat, and does not require ſo looſe a mould, it is ſowed after only two plowings. 2. If each plant drew from the earth none but thoſe juices which are proper to its ſpecies, why need the land be reſted every third year? We need only ſow wheat the firſt year, barley the ſecond, oats the third, peas the fourth, and turneps the fifth; ſo that if wheat were to be ſown again, it would be on land that had reſted five years from that kind of grain.

The moſt ignorant in farming will allow, that only poor crops will be obtained by ſuch management; becauſe all ſorts of plants exhauſt

exhauſt the earth: and beſides, during the fallow, great pains is taken in plowing, by which means the earth is broken, the ſpaces between its particles are multiplied, and conſequently it is rendered fit for producing plants which require a fine tilth, ſuch as wheat, and is not exhauſted by other productions.

In ſhort, if each plant drew from the earth only the particular juice proper for itſelf, poppies, thiſtles, *&c.* which kill wheat, would do it no hurt. Wheat might, in that caſe, grow as well in a common, as in a well plowed field. Let it not be alledged, that it is the ſtalks of weeds which hurt the wheat, and not the roots by the juices they conſume; for if dry branches were to be ſet in ſuch numbers as to make a greater ſhade than thoſe weeds, they would not equally hurt the growth of the wheat.

Thoſe who think that every plant draws a particular juice from the earth, allow that the ſubſtances proper for the nouriſhment of each plant, ought to be diſſolved in a quantity of water ſufficient to convey them into the plant. But if weeds abſorb all that water, none will remain for the nouriſhment of the plant that is cultivated.

An obſervation which ſeems to me of greater force than thoſe I have yet mentioned, is, that a poor land, when reſted, produces of itſelf a number of plants; and after having continued to feed thoſe productions for years together, without any culture, it is ſtill able to bear ſome good crops. The reaſon of this is ſaid to be, that the plants which grow ſpontaneouſly upon that land, have not exhauſted the ſubſtance which is neceſſary for the food of wheat.

It is likewiſe obſerved that lands which have long borne ſain-foin or luſerne, afterwards produce very fine wheat.

Anſwer. This obſervation ſeems to contradict the opinion of plants of different ſpecies, being nouriſhed by the ſame kind of juices. But it is to be obſerved, 1. That lands are neither ſo ſpeedily, nor ſo well improved by being reſted, as by proper culture. 2. While land is reſted, the rains, dews, and winds, lodge in it many particles fit for the nouriſhment of plants. The graſs or weeds which grow on it afford food to cattle, which enrich the land with their dung; and the roots and leaves of the graſs or weeds rot and add to its fertility. In ſuch poor looſe lands, theſe rich particles ſink lower than the roots of common graſs reach, and are thereby heaped up till the land is plowed, and then they become the food of wheat,

wheat, &c. If tap-rooted graſſes grow in it, their roots enrich the ground greatly when they putrify in it; beſides that ſuch plants drop many of their leaves, which likewiſe rot, and by ſhading the earth, greatly mellow it.

Another obſervation which does not agree with the identity of food we have hitherto ſuppoſed, is, that maſlin corn, which is a mixture of wheat and rye, ſucceeds in ſuch light ſoils, better than wheat alone; and that a mixture of oats and vetches thrives very well, where oats alone would ſcarcely grow.

To this it may be anſwered, that thoſe mixtures of wheat and rye, or oats and vetches, thrive better together, than wheat or oats would do alone, becauſe the rye and vetches, being quick growers in ſuch ground, ſhelter the wheat and oats from the ſcorching ſun and drying winds, till they have attained ſufficient ſtrength to reſiſt them.

From what has been ſaid, I think we may conclude;

1. That many plants of different ſpecies feed on nearly the ſame ſubſtance.

2. That there is no plant which does not rob thoſe that are within its reach, of ſome part of their food.

3. That the ſoil which once is good for one kind of plant, will always be able to ſupply it with food, provided it be cultivated properly.

If theſe propoſitions are true, it follows that there is no neceſſity to change the ſpecies of plants from one year to another, on account of the different nouriſhment which the earth is ſuppoſed to yield them.

It cannot however be denied, but that, in following the common principles of agriculture, there is an advantage in ſowing different plants ſucceſſively in the ſame land. But this may be owing to three cauſes, very different from thoſe to which we have oppoſed ſeveral objections.

The firſt, is the quantity of food which is neceſſary to ſome plants.

The ſecond, is the particular conſtitution of each plant; ſome being more tender than others.

The third, the degree of tillage which each plant requires.

All plants do not draw a like quantity of nouriſhment from the earth. A proof of this is, that there are poor light grounds which produce rye, millet, and buck-wheat, but cannot produce wheat, or even oats.

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On the other hand, there are plants whoſe roots can force their way into a very hard ſoil, which others cannot penetrate. For inſtance, I believe the roots of oats pierce a hard ground more eaſily than the roots of barley: for I have ſeen oats do tolerably well in ſtiff lands that had been plowed but once; whilſt at leaſt two plowings are neceſſary, in looſer ſoils, to have a good crop of barley.

It may be inferred from hence, that, in the common huſbandry, oats ought to follow wheat: for as wheat is ſowed ſoon after harveſt, there would be ſcarcely time to plow the earth once; whereas it muſt be plowed at leaſt three times, if one would have a good crop of wheat.

With regard to oats and barley, as they are not ſown till ſpring, there is leiſure enough to give them the neceſſary plowings: and the year of fallow affords ſufficient time to give the land intended for wheat, the four plowings which are neceſſary for that grain.

If therefore you would always ſow wheat in the ſame land, it muſt be ſowed only every ſecond year, and left fallow each intermediate year, in order to give it the neceſſary plowings. By this means, I believe it would always produce good crops.

Mr. Tull relates a fact, which proves what we have juſt advanced. A farmer ſowed a very rich piece of land with wheat, in the uſual way. It grew ſo rank, that it lodged, and yielded but little grain. The owner, depending on the richneſs of his ground, plowed it but once, and ſowed it again with wheat, in hopes that being leſs rank than the former, it would yield him a better crop. But it happened quite otherwiſe. His wheat came up ſo weak, that it ſcarce yielded the value of the ſeed. A manifeſt proof that wheat cannot do well in land that has not been ſufficiently plowed.

Wheat thrives well after a crop of turneps: and no wonder; for turneps are ſown in land in very fine tilth, and the earth is kept in a looſe ſtate while they are growing. By this means, the wheat is in land which has had more ſtirring than is uſually beſtowed upon it. Add to this, that as cattle are generally turned into the ground to feed upon the turneps, the land is well dunged by them.

Care ſhould be taken not to ſow wheat on land that has been under ſain-foin: for the earth which has not been plowed for the nine or ten years that the ſain-foin grew on it, cannot be brought to a ſufficient tilth for wheat by one or two plowings. It may do for oats, which is the grain that is generally ſown after it.

Let us conclude then, that it is poſſible to have a good crop of wheat every year off the ſame land. All that is required to that end, is, to plow oftener; to divide the particles of the earth ſufficiently; to put the plants in condition to ſeek their neceſſary food; to hinder weeds from robbing the cultivated plants; and laſtly, to raiſe no more plants in a field, than it can nouriſh properly. All theſe advantages are obtained by the new Huſbandry.

CHAP. V.

Of the diſtribution of the Food of Plants within the Earth.

THE food of plants, of whatſoever nature it be, is diſperſed throughout every part of the earth: but it would lie uſeleſs there, if plants could not get at it. They muſt be able to extend their roots between the particles of the earth. Too ſtiff a ſoil, that is to ſay, a ſoil of which the particles lie too cloſe together, hinders their extenſion. It is therefore neceſſary that there ſhould be ſpaces between thoſe particles, through which the roots may be extended. Moſt ſoils have, by nature, internal pores: but they are, in general, either too few in number; or not properly fitted to the roots.

If they are too few, there will often be a want of communication betwixt one pore and another; and the roots thereby impeded in their progreſs, will not be able to find the food neceſſary for the plant. This is the defect of too ſtrong lands.

If the interſtices are too great, the roots, paſſing through them without ſcarcely touching the earth, will draw little or no aſſiſtance from it: this is the defect of light lands.

Both theſe defects may be remedied by proper culture: for the earth contains ſo great a quantity of nutritive juices, that there is no danger of exhauſting them. The only point is, to enable the roots to reap the benefit of them. It is ſtill leſs to be feared, that this nouriſhing juice may diſſipate or waſte itſelf. Experience demonſtrates that it cannot: for let earth be dried to ever ſo great a degree, let it be pulveriſed, and expoſed to the ſun, rain, and froſt; it will only become the more fertile for it.

It is certain, that water ſhould diſſolve the particles deſtined for the food of plants; and that this vehicle is almoſt entirely diſſipated by tranſpiration, after it has depoſited in plants what is to be converted into their ſubſtances. But when water evaporates from the earth, without paſſing through plants, it does not carry the nutritive parts

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off with it; ſince, as we before ſaid, earth that is left to reſt, inſtead of being exhauſted, becomes more fruitful thereby.

To increaſe the fertility of land, there is not ſo much occaſion to provide it with the ſubſtance which is to nouriſh plants, as to diſpoſe it in ſuch manner that the plants may, by their roots, collect and draw in thoſe juices which almoſt all ſoils are abundantly ſtored with. To this end, the particles of the earth muſt be ſo divided as to leave an infinite number of ſmall chaſms between them, into which the roots may glide; ſo that, touching immediately the particles of the earth, they may draw the nutritive juices from them. This diviſion of the earth may be effected by manures, and by tillage, as we ſhall ſhew in the following chapter.

CHAP. VI.

Of TILLAGE.

THE more the particles of the earth are divided, the more its internal pores are multiplied: the more the ſurface of thoſe particles is increaſed, the more the earth is enabled to finiſh the food of plants; and conſequently the more fruitful it is rendered.

This diviſion may be effected two ways: by fermentation, that is, by mixing dung with the earth; or by breaking its parts mechanically, by tillage, whether it be with the ſpade, plough, or hoe, or any of the different inſtruments that have been invented to ſtir the earth.

It is much more profitable to increaſe the fruitfulneſs of land by tillage, than by dung. 1. Becauſe only a certain quantity of dung can oftentimes be had, the produce of twenty acres being ſcarcely ſufficient to dung one: whereas the particles of the earth may be divided and ſubdivided, *ad infinitum*. The benefit that can be procured from dung, is therefore limited; whereas no bounds can be ſet to the advantages which ariſe from tillage.

2. Moſt plants that are rear'd in dung, have not the fine flavour of thoſe that grow in a good ſoil which has not been dung'd. Greens and fruits are ſeldom ſo good in the neighbourhood of great cities, where dung abounds, as in country gardens where it cannot be ſo laviſhly beſtowed. But nothing is more ſtriking than the difference between wine produced by a vine that has not been dung'd at all, and that which is made from a vine that has been greatly dung'd.

Mr. Tull goes ſo far as to inſinuate, that dung gives plants poiſonous, or at leaſt hurtful qualities: but his arguments ſeem to want weight. For example, when he ſays that venomous creatures are oftener found in dung than elſewhere, and mentions the toad as an inſtance of it; it may be affirmed that toads are not venomous: and if they were, is it not well known that hemlock frequently grows in gardens, cloſe by a very wholeſome plant? Beſides, there is great reaſon to think that a plant which by its nature is poiſonous, would be leſs ſo when raiſed in a well-dung'd ground, than if it had grown in a poor dry ſoil; by the ſame rule that ſelery acquires a ſtronger and higher flavour, in a poor, than in a well-dung'd ſoil.

3. Dung, which, according to Mr. Tull, acts by fermentation, cauſes indeed an internal diviſion of the particles, which may be of great uſe: but the plough not only divides the particles, but changes their ſituation, by turning the earth upſide down. The part which was expoſed to the influences of the air and dews, takes the place of another part which is removed from underneath to the ſurface, and the earth that is turned up is penetrated by the rain and dew, and by the rays of the ſun; all which greatly conduce to render it fertile.

4. Dung harbours inſects, which afterwards feed upon the plants and ſpoil them. It is well known, that when lands are dunged in which trees are planted, their roots are in great danger of being hurt by inſects: and this is one of the chief reaſons why floriſts baniſh dung from their gardens.*

5. It is true that dung is equally beneficial to light and to ſtiff grounds; but the ſame may be ſaid of tillage; and the following is the manner in which Mr. Tull ſays this laſt acts upon both thoſe kinds of land.

Too ſtrong land is that of which the parts are ſo cloſe, that roots cannot penetrate them without great difficulty. Now, if roots cannot extend themſelves freely in the earth, they cannot draw from it the food of plants, which, for want of that food, will droop and languiſh. But when thoſe lands ſhall have been divided by tillage, when

* We invite all lovers of agriculture to try the following method, which we think may be attended with ſucceſs.

Let a reſerve of quick-lime be kept in a very dry place.

When you begin to make your dunghil, ſprinkle each layer of dung with quick-lime, till the whole is finiſhed. This kills moſt inſects, and perhaps enriches the dung and renders it more ſerviceable. This lime will likewiſe deſtroy the ſeeds of weeds which generally are in dung, and which hurt the wheat when they ſhoot up.

when their particles ſhall have been ſo ſeparated, that roots are at liberty to extend themſelves and traverſe all thoſe ſmall ſpaces, they will be able to ſupply the plants with their neceſſary food, and they will thrive apace.

Tillage is equally beneficial to light lands; but for a contrary reaſon. The fault of theſe lands, is their having too great ſpaces between their particles; and as moſt of thoſe ſpaces have no communication one with another, the roots traverſing the great cavities without touching the particles of the earth, draw conſequently no nouriſhment from it. But when the particles have been broken by repeated plowings, the leſſer intervals are multiplied at the expence of the greater: the roots have liberty to extend themſelves, and they glide in, as it were, between the particles, meeting with a certain reſiſtance which is neceſſary to their taking in their nutritive juice which the earth contains.

Mr. Evelyn, quoting Sir Hugh Platt, ſays, "that if you take a "certain quantity of even the moſt barren earth you can find, re"duce it to a fine powder, and expoſe it for a year to the viciſſitudes "and changes of the ſeaſons, and influences of the heavens, it will "acquire ſuch a generous and maſculine pregnancy, within that "period, as to be able to receive an exotic plant from the fartheſt "Indies, and to cauſe all vegetables to proſper in the moſt exalted "degree, and to bear their fruit as kindly with us, as they do in "their natural climates." We are to ſuppoſe theſe exotics to have their due degrees of heat and moiſture given them. To what ſhall we aſcribe this great fertility? Moſt probably it is owing chiefly to the great diviſion of the particles of the earth, and the multiplication of their ſurfaces. "By this toil, (*viz.* pulverizing the earth) adds "he, 'tis found, that ſoil may be ſo ſtrangely altered from its former "nature, as to render the harſh, and moſt uncivil clay, obſequious "to the huſbandman, and to bring forth roots and plants, which "otherwiſe require the lighteſt and holloweſt moulds."

What Mr. Evelyn ſays, does not, however, hold good with reſpect to every kind of earth: for I have pulveriſed ſtiff clay, and ſifted it through a pretty fine ſieve; notwithſtanding which, after it was well ſoaked with water, it became as cloſe and compact as it was before I pounded and ſifted it.

From this experiment it might be inferred, that dung is more neceſſary for clay lands than for any other, becauſe it prevents the particles reuniting after they have been divided by tillage. But dung is

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not leſs neceſſary for light lands, which, as they contain few nutritive parts, ſtand in need of being ſupplied with them by dung.

This is nearly the ſubſtance of what may be ſaid on the ſubject of dung, the uſefulneſs of which cannot be denied, (as Mr Tull ſeems to do) without contradicting the experience of every age and place.

But whatever advantage may be reaped from dung, by thoſe who have the convenience of being plentifully provided with it, and that of correcting part of its defects by lime; it will not be the leſs true, that it is extremely beneficial to multiply the frequent plowings of the earth.

'Tis for this reaſon that lands intended to be ſown with wheat, are plowed three or four times. Some farmers who have doubled the number of plowings, have found their lands more fertiliſed thereby, than if they had been greatly dunged. Three plowings extraordinary, do not coſt half ſo much as one dunging. Thus an ill-judged œconomy becomes ruinous.

It follows from all this, that there is room for improvement in the culture of land. Plowing, as it is performed in ſome countries, for wheat, does not meliorate ſtiff lands. It only forms huge clods, which leave great cavities between them, by no means fit to ſupply plants with food. This muſt be allowed, after what has been ſaid above. It is therefore abſolutely neceſſary to break the clods thoroughly, and to reduce them to ſmall particles, by plowing. The ſtiff land, then grown lighter, is in a ſtate that ſuits the plants. Nothing more is wanting, but to keep it in that ſtate by plowings made at proper ſeaſons, as we ſhall explain hereafter, to prevent it's returning to its former condition.

But what proves how beneficial it is in ſtrong lands to facilitate the paſſages of the water, of the rays of the ſun, and of the roots of plants, is, that their fertility is ſometimes increaſed by mixing them with ſand inſtead of dung. Sand itſelf affords no nouriſhment: but by preventing the particles from re-uniting, it produces the deſired good effects.

It does not appear, that light grounds require quite ſo many plowings. It might even be feared, leaſt by frequent turning of ſuch lands, and expoſing their parts to the ſun, they might be exhauſted. But tho' the ſun robs the earth of its moiſture, yet few of the particles fit for the nouriſhment of plants are exhauſted with it; and experience ſhews, that light lands are bettered by being plowed; either

ther becaufe the breaking and ftirring of their particles renders them fitter to receive the moifture of rain and dew, to profit by the influences of the air, and be penetrated by the rays of the fun; or that, as Mr. Tull thinks, the internal pores are better fitted for the extenfion of roots; or again, becaufe frequent plowings deftroy weeds, which are more apt to grow in light grounds than in ftrong, efpecially when they are dunged.

To prove by an experiment, what we have juft advanced with refpect to light foils: let us fuppofe one half of a field to be indifferently plowed, and the other half to be plowed extremely well. Some time after, and in dry weather, let the whole field be crofs-plowed. The land of that half of the field which was thoroughly plowed, will be of a darker colour than that of the other half which was but flightly plowed. This fhews the benefit the land has received by plowing.

Some break the clods of earth with a roller. This is of great fervice when the land is not too wet, in order to prepare it for plowing. But if the earth is very moift, the roller will do it more hurt than good.

Others think to fupply the want of plowing, by harrowing their land greatly after it has been fown. But this way of fcratching the earth is of little fervice; and when it is moift, the horfes poach and damage it confiderably.

CHAP. VII.

Of the management of Lands newly broke up.

WE fhall treat in this chapter of lands which have not been fown of a long time, and which are to be fitted for wheat or other grain.

Such lands may be divided into four claffes, *viz.* 1. Wood-lands, 2. Commons. 3. Pafture, or Meadow. 4. Marfhy-lands. We fhall fpeak of each of them feparately.

I. *Of Wood-lands.*

WOOD was formerly fo common, that people did not take the trouble to cut it down. When they wanted to convert a piece of wood-land into arable, they fet fire to the trees, and their afhes were thought to afford a confiderable manure. But this operation did

did not exempt them from the labour of grubbing up the ſtumps and roots, and afterwards levelling the ground.

But timber is now ſo ſcarce, that great care is taken to preſerve it. The ſtumps are grubbed up, and a profit is found even in digging up the roots.

The earth is ſo thoroughly ſtirred by digging up the ſtumps and roots, that one plowing in autumn is generally ſufficient. The winter froſts kill the weeds, and break the clods; and after a ſecond plowing in ſpring, theſe lands may be ſown with expectation of an abundant crop: for the trees not having exhauſted the earth towards the ſurface, but having on the contrary manured it with their leaves, a conſiderable produce may be expected for many years.

We had a ſmall field, which had formerly been under wood. It produced us plentiful crops of wheat and oats for upwards of twenty years together, without being reſted. 'Tis true the ſoil was peculiarly adapted to wheat, and would have been exhauſted much ſooner if it had been a poorer earth.

II. *Of Heaths and Commons.*

BROOM, ruſhes, fern, heath, buſhes, and briars, are the general produce of heaths and commons, which it is adviſeable to burn, not only becauſe their aſhes enrich the earth, but likewiſe becauſe the fire prevents their roots from ſhooting up anew, and deſtroys the greateſt part of their ſeeds which would otherwiſe grow.

The fitteſt time for burning them is towards the end of ſummer, when the plants are withered. But great care muſt be taken that the fire extend no farther than is intended; for we have ſeen two thouſand acres of wood burnt and entirely deſtroyed by the ſpreading of the fire when the graſs was dry.

This care conſiſts chiefly in clearing away all the graſs on the ſide you would preſerve from the flames, for a diſtance ſufficient to prevent all communication. The graſs that is cut down there, is ſpread upon the part intended to be burnt, and ſerves to kindle the fire, after it is dry.

Beſides this precaution, a fair day muſt be choſen, when the wind does not blow towards the wood. By kindling the fire then on the ſide the wind blows from, you prevent its ſpreading farther that way, and ſee it remove gradually up into the heath or common. The fire ſhould be carefully watched, for fear of accidents. If, not-

notwithſtanding theſe precautions, it ſhould extend to places intended to be preſerved, it may be ſtopt by water if any is at hand. But the moſt effectual way is to dig a trench: for by throwing up the earth on the ſide where the fire is, you cover the graſs, and thereby hinder the further progreſs of the flames.

When the whole ſurface of the common is burnt, the roots of the different ſhrubs which are ſo ſtrong as to ſtop the plough, are dug up with a pick-ax: and after the earth has been moiſtened by the autumnal rains, it is plowed into high-ridges, with a ſtrong plow, and with the help of a ſecond plowing in ſpring, it may be ſown with oats. The ſecond year, it ſhould have three thorough plowings; and the third year it will be fit to bear a good crop of wheat. But it muſt be by dint of plowing, that the fern, ruſhes, &c. are prevented from ſprouting up again; for it is very difficult, tho' not impoſſible, entirely to deſtroy them. The winter plowings will kill the roots, by expoſing them to froſt; and the ſummer plowings, by expoſing them to the heat of the ſun.

In many countries, the method of burning is different, and leſs liable to accidents.

They cut down the broom, thorns, and other large plants, and ſell them, or lay them in their farm-yards, or roads, to make dung. The ſtumps are then grubbed up, and laid in heaps intermixed with ſmall twigs. Theſe heaps are diſpoſed in a quincunx form. The whole common is afterwards pared, and the turf dried. This operation rids the ground of all the young broom, and other remaining plants. The turf is laid upon the piles of roots in dry weather, and ſet on fire. The aſhes are then ſpread, and the ground is plowed.

Mr. Worlidge adviſes uſing an inſtrument invented by Mr. Gabriel Platt, for ſtubbing up thorny ſhrubs, broom, goſs, &c. as the eaſieſt and leaſt expenſive way. This inſtrument is like a three-grained dung-fork, but much greater and ſtronger: the ſtale thereof like a large and ſtrong leaver. This being ſet about half a foot from the root of the ſhrub, is drove a good depth into it with a hedging-beetle. The ſtale is then elevated, and a weight, or fulciment, as he calls it, laid under it, after which it is pulled down with a rope faſtened to the upper end, and wrenches up the whole buſh by the roots.

III. *Of Meadows and Pasture-lands.*

THIS article comprehends sain-foin, luserne, clover, and in general all grounds intended to be plowed, in order to their being sown. It likewise comprehends lands which are plowed only every eight or ten years, either because they are too poor to bear a crop every year, or because the country is not sufficiently inhabited for all its lands to be cultivated.

With respect to grass-lands of every kind, the farmer usually contents himself with plowing them well. But as ground which has rested a long time, is very hard, it is impossible to plow it till it has been softened by the autumnal rains.

This plowing, which must be performed with a strong plough, necessarily leaves the land very rough and full of large clods, which are mouldered by the winter's frost and rain; so that a second plowing, if the spring is not too wet, fits it for sowing oats. Wheat must not be sown in it, till by frequent plowings the earth has been brought to a sufficiently fine tilth for that grain, which requires more nourishment than oats.

Lands which are plowed only every eight or ten years, are commonly burnt, that the fire may divide their particles, and the ashes of the leaves and roots add to their fertility. As this process may properly be called a manure, we shall speak of it in the chapter of *Manures*.

IV. *Of moist Grounds.*

WE do not mean to treat here of the draining of marshes, but only to speak of such lands as, lying low, are overflowed with water from the neighbouring grounds; or of those, which, by their holding of water, are always so moist that they cannot be plowed.

In this case, if the land intended to be plowed, has any sort of declivity, it will be sufficient to surround it with a ditch, to receive the water from the neighbouring grounds, and likewise to carry off it's own too great abundance of moisture. But if there be a bottom in the middle of this land, it will be necessary to drain it, by a ditch, which shall empty itself into the surrounding ditch.

When the ground is nearly level, our farmers cut deep furrows with a trenching-plough.

The land, being thus dried, is treated in one or other of the before mention'd methods.

CHAP.

CHAP. VIII.

Of MANURES.

THE particular application of dung, we ſhall have occaſion to mention hereafter. Like other compoſts, it acts by fermentation; crumbling and dividing the earth very much; and therefore it is of moſt ſervice in the old huſbandry, in which the earth is not ſo much pulveriſed, by tillage, as in the new. The fermenting quality of dung, is chiefly owing to the ſalts wherewith it abounds: but a very little of theſe ſalts, ſays Mr. Tull, applied alone to a few roots of almoſt any plant, will kill it: ſo very fiery and acrimonious is their nature. This defect is in ſome degree remedied, either by keeping the dung till it grows mild, or by mixing it with the earth ſome time before the grain is ſown. It is then of ſuch ſervice to moſt corn-fields, that little good can be done without it in the common huſbandry.

Lime is frequently mixed with dung, and becomes an uſeful addition, not only as a manure, but as it prevents the dung's being a neſt for inſects, ſo much as it would otherwiſe be; and likewiſe helps to kill many of the ſeeds of weeds that are generally in it; tho' ſome, for example charlock-ſeeds, will remain unhurt for years together, amidſt all the fermentation of a dunghil, and ſtill retain their vegetative power; when at the ſame time that continued fermentation has been ſufficient to deſtroy the power of the ſtercoraceous ſalts of the dung.

The action of the dung's ferment, is generally thought to afford a warmth to the infant plants, in their moſt tender ſtage, and the moſt rigorous ſeaſon. But this advantage is greatly counter-balanced by the dung's letting water enter its hollows, and thereby becoming, in thoſe parts, much colder in froſt, than un-dung'd pulveriſed earth. As a confirmation of this, Mr. Tull ſays he has ſeen wheat-plants in the winter die, in the very ſpits of ſeemingly well-rotted dung; when un-dung'd drill'd wheat, cloſe by, and planted at the ſame time, has flouriſhed all the ſame winter.

By dung we mean only the excrements of animals, and what is uſually collected in the offices and dung-yard, which is more or leſs uſeful in proportion to the quantity of ſalts it contains.

The quantity of vegetable food made by tillage without dung, is beyond compariſon greater than that made by dung without tillage.

This laſt reaches but little lower than the ſurface of the earth: the other extends to the whole depth of the ſtaple.

Dung, without tillage, can do very little; with ſome tillage, it does ſomething; with much tillage, it pulveriſes the ſoil in leſs time than tillage alone can do: but tillage alone, with more time, and *much leſs expence*, can pulveriſe it as well, and avoids all the inconveniencies of dung.

I cannot help joining with the author of the *new Syſtem of Agriculture*, in his ſevere cenſure on our country gentlemen, p. 114. " It is to me," ſays he " a ſurprizing proof of our gentlemen's inap-" titude to this noble art, (agriculture) to ſee ſo many hundred " thouſand acres peſtered, and corrupted, by *common dung*, the " bowels of which very land are loaded with inexhauſtible quanti-" ties of rich and wholeſome phyſick for its own diſeaſes.——*Dung* " is not only prejudicial to ſome ſoils, but inferior to the worſt of " other compoſts, upon *any*. One would wonder to ſee, how peo-" ple put themſelves to extraordinary charges, and the inconvenience " of ſending to great diſtances for *horſe-dung*, to manure thoſe very " lands which never fail of being verg'd, or bottom'd, by a ſub-" ſtance of one kind or other, by far more proper for the end they " aim at: And, therefore, I lay it down as a rule, almoſt without " exception, that every ſoil, of what nature, ſituation, or condition " ſoever, abounds with natural and ſufficient *helps* for its peculiar " *imperfections*."

It will next be right to inquire what the properties and uſes of theſe natural manures are, ſo much recommended by this author, and what ſoils they are ſuited to. To this end, we ſhall divide ſoils into three ſorts, *viz.* clay, ſand, and loam; and, in ſeparate articles, propoſe the improvements of each.

I. *Of Clay.*

" CLAY," ſays Mr. Evelyn, p. 22, of his *Terra*, " is of all " other a curſt ſtep-dame to almoſt all vegetation, as having few " or no *meatus*'s for the percolation of the alimental ſhowers, or ex-" panſion of the roots; whether it be the voracious, hungry, weep-" ing, or cold ſort. In theſe caſes *laxatives* are to be preſcribed, " ſuch as drift *ſand*, ſmall *gritty gravel*, *ſaw-duſt*, with *marl* or " *chalk*, and continually vexing it with the ſpade or plow; but above " all, with *ſea-ſand*, where it may be procured, and the burning of " the ground to *aſhes*, and all that it bears, the more the better; for

"for by no lefs feverity will this ill-natur'd mould be fubdued: "*rotten-wood*, and the bottom of bavine-ftacks, are good ingredients "to this manure; and if it be a cold and wet fort, ftrewings of "*foot* are good; if very ftiff, rubbifh of *brick*, *lime-ftone*, and fuch "trafh, may properly be laid at the bottom, and on the upper part "*compofts* of *dung*."

Rotten-wood, and faw-duft when rotted, fays Mr. Miller too, is a very good manure for ftrong lands, becaufe it loofens the parts of the earth, and renders it light.

Mr. Lifle, Vol. I. p. 26. advifes, as a good way, "to tame harfh, "churlifh, obftinate clay, to fling it up in ridges in the winter, and "after the firft froft, when it thaws and molders, to fling and tem-"per amongft it afhes or chalk, or whatfoever you have to qualify "it: for the time being nickt, wherein you can catch the clayey "corpufcles under the greateft difunion and feparation, is the time "for keeping them fo, by mixing thefe other lighter bodies "amongft them, which will the longeft prevent them from their "re-union."

Sea-fand and fhells are ufed to great advantage as a manure, in many places where they can be had without too much expence. Mr. Miller advifes them chiefly for cold ftrong land, and loam inclining to clay. They feparate the parts; and the falts which are contained in them, are a very great improvement of land. Coral, and fuch kind of ftony plants which grow on the rocks, are filled with falts which are very beneficial to land. But as thefe bodies are hard, the improvement is not the firft or fecond year after they are laid on the ground, becaufe they require time to pulverife them before their falts can mix with the earth to impregnate it. The confequence of this is, that their manure is lafting. Sand, and the fmaller kinds of fea-weeds, will inrich land for fix or feven years; and fhells, corals, and other hard bodies, will continue many years longer.

In fome countries, at a great diftance from the fea, great quantities of foffil-fhells have been difcovered, and ufed with fuccefs as manure: but they are not near fo full of falts, as thofe fhells which are taken from the fea-fhore; and therefore the latter are always to be preferred.

Sea-fand is much ufed as manure in Cornwall, fays Mr. Borlace in his Natural Hiftory of that county. The beft is that which is intimately mixed with coral. In places where this excellent manure

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is found, it is taken up by a large bag of the ſtrongeſt canvas, to the mouth of which is fitted an iron hoop or frame for keeping it open, and ſinking it to the bottom of the ſea, ſo as it may receive the ſand and coral as it is dredged along by the bargemen. A barge-load is uſually delivered for ten ſhillings, or leſs if near the place of dredging: and where the land is good, a barge-load will dreſs an acre. It is uſed more for corn, than paſture grounds. It gives the heat of lime, and the fatneſs of oil, to the land it is laid upon. Being more ſolid than ſhells, it conveys a greater quantity of fermenting earth in equal ſpace. Beſides, it does not diſſolve in the ground ſo ſoon as ſhells, but, decaying more gradually, continues longer to impart its warmth to the juices of the earth. It is chiefly found in Falmouth harbour, and the ſhores adjoining. Not only ſea-ſand is uſed as manure by every one who has it in his reach, but after ſtorms they find the *alga marina*, *fucus*, *conſerva*, or ore-weed, one of the beſt manures which nature affords, ſcattered in great plenty on the ſhore. Being a ſub-marine plant, the wind and ſun ſoon exhale its moiſture: the ſooner therefore it is taken from the ſhore, the better; and being ſpread on old and ſtiff earth, then covered with ſand, it ſoon diſſolves into a ſalt oily ſlime.

This is the moſt approved way of applying it. Some lay it naked and freſh from the ſea, upon their barley lands, in the end of March and beginning of April, and have a good crop of corn: but the weeds grow ſo plentifully and rank afterwards, that no wholeſome graſs for paſture is to be expected for that year. Sir George M'Kenzie obſerves (Phil. Tranſ. No. 117.) that lands often uſed to this manure yield bad oats, and in a ſmall quantity, the huſks thicker than ordinary, and more darnel among the corn, than in lands which have not ſo much ore-weed laid upon them.

The uſe of ſand, as Mr. Miller obſerves, is to make the clayey earth fertile, and fit to feed vegetables, *&c.* for earth alone, we find, is liable to coaleſce, and gather into a hard coherent maſs, as is apparent in clay; and earth thus embodied, and, as it were, glued together, is no ways diſpoſed to nouriſh vegetables: but if with ſuch earth, ſand, *&c.* *i. e.* hard cryſtals, which are not diſſolvable in water, and ſtill retain their figure, be intermixed, they will keep the pores of the earth open, and the earth itſelf looſe and incompact, and by that means give room for the juices to aſcend, and for plants to be nouriſhed thereby.

Thus, a vegetable, planted either in ſand alone, or in a fat glebe, or or earth alone, receives no growth or increment at all, but is either ſtarved or ſuffocated: but mix the two, and the maſs becomes fertile. In effect, by means of ſand, the earth is rendered, in ſome manner, organical; pores and interſtices being hereby maintained, ſomething analogous to veſſels, by which the juices may be conveyed, prepared, digeſted, circulated, and at length excerned, and thrown off into the roots of plants.

"Sea-ſand," continues Mr. Miller, "is accounted a very good "compoſt for ſtiff ground, for it effects the two things following, "*viz.* It makes way for the tree or ſeed to root in ſtiff ground, and "makes a fume to feed it."

Chalk, lime, rubbiſh of old houſes, or, in ſhort, whatever looſens the body of the clay, are good manures.

Shell-Marle, or any marle, which, dropt into vinegar, makes a ſtrong effervеſcence, is a peculiarly good manure for clay: for, diſſolving eaſily in water, it gives a freer paſſage to it, whereby the clay is kept dry even in winter; and if the clay is of a cold acid quality, the abſorbent quality of the marle deſtroys that acidity, and keeps the clay warm. Many late experiments prove the truth of this, its effects being much beyond what could have been expected.

In very cold moiſt land, ſays Mr. Miller, I have frequently ſeen new horſe-dung buried as it came from the ſtable, and always obſerved that the crops have ſucceeded better, than where the ground was dreſſed with very rotten dung.

Sheeps dung and deers dung are nearly of the ſame quality, and are eſteemed by ſome the beſt of dungs for cold clays. Some recommend beating them into powder, and ſpreading them very thin over autumn or ſpring crops, about four or five loads to an acre, in the ſame manner that aſhes, malt-duſt, *&c.* are ſtrewed. But theſe light dreſſings do not laſt long.

In Flanders, and other parts, they houſe their ſheep at nights in places ſpread with clean ſand, laid about five or ſix inches thick; which, being laid on freſh every night, is clear'd out once a week. This mixture of ſand and dung, makes an excellent dreſſing for ſtrong land; for the dung and urine of the ſheep is a very rich manure. Mr. Quinteney thinks it the greateſt promoter of fruitfulneſs in all ſorts of ground. Others recommend hogs dung, as the fatteſt and moſt beneficial of any.

The dung of pigeons and poultry is eſpecially good for cold, wet, clayey lands: but it ought to be dried before it be ſtrewed, becauſe

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it is naturally apt to clod in wet; and it ſhould be mixed with earth or ſand to keep it from clogging together, that it may be ſtrewed thin, being naturally very hot and ſtrong.

Human dung is another great improver of all cold ſour lands, and eſpecially if it be mixed with other earths or dungs to give it a fermentation.

But there is not any ſort of manure equal to the cleanſing of the ſtreets of great cities, for all ſtubborn clayey ſoils, the parts of which will be better ſeparated, and in a much leſs time, with this manure, than with any other compoſt whatever.

II. *Of Sand.*

BY the ſame rule that ſand fertiliſes ſtrong clayey grounds, clay meliorates light and ſandy ſoils. But this manure can never have its due effect, unleſs it be well broken, and divided into ſuch ſmall particles as to be able to incorporate thoroughly with the light earth.

"Arenous and ſandy earth," ſays Mr. Evelyn, p. 19. wants ligature; and beſides, conſiſting of ſharp and aſperous angles, wounds " and galls, curls and dwarfs our plants, without extraordinary help, " to render the paſſages more ſlippery and eaſy: and therefore re- " lenting *chalks*, or *chalk-marle*, is profitable, with *calcinations* of " *turf*, or *ſea-wrack*, where it is at hand: and if the ſoil be exceed- " ing bibulous, ſpread a layer or couch of *loam*, diſcreetly mingled, " at the bottom, to entertain the moiſture.———Sand, being of an " open and looſe contexture, is apt to put forth a forward ſpring, " as more eaſily admitting the ſolar rays: but it does not continue, " and is an infirmity which may be remedied with *loam*, which not " only unites it cloſer for the preſent, but is capable in time to alter " and change its very nature alſo, ſo as too hot a *compoſt* be no in- " gredient with it.———If the ſoil be *ſandy*, or other light mixed " earth, imbody it with ſomething of a fatter nature, as *marl*; and " be ſure ſo to ſtir and lay it (eſpecially if with *loam*) that it may " not ſink too deep, and ſuddenly, as 'tis apt to do, and ſo deſert the " ſurface-mould, where it ſhould do the feat, and therefore it is to " be the oftener renewed."

Dr. Liſter divides the Engliſh ſands into two claſſes: the firſt, ſharp or red ſand, conſiſting of ſmall tranſparent pebbles, naturally found on the mountains, and not calcinable: the ſecond, ſoft or ſmooth.

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Mr. Miller obſerves that, grounds which are ſandy and gravelly, eaſily admit both of heat and moiſture; but then they are liable to theſe inconveniencies, that they let them paſs too ſoon, and ſo contract no ligature, or elſe retain them too long, eſpecially where there is a clay bottom; and by that means they are either parched or chilled too much, and produce nothing but moſs and cankerous infirmities; but if the ſand happens to have a ſurface of good mould, and a bottom of gravel or looſe ſtone, though it do not hold the water, it may produce a forward ſweet graſs; and though it may be ſubject to burn, yet it quickly recovers with the leaſt rain.

Sand indeed is apt to puſh the plants that grow upon it, early in the ſpring, and make them germinate near a month ſooner than thoſe that grow upon clay; becauſe the ſalts in the ſand are at full liberty to be raiſed and put into motion, upon the leaſt approach of the warmth of the ſun: but then, as they are haſty, they are ſoon exhaled and loſt.

Clay is another excellent manure, ſays the author of the *New Syſtem of Huſbandry*, p. 124. and eaſy enough to be found in all places: but you muſt obſerve, 'tis only uſeful upon *ſandy* grounds, or any lands of a nature entirely different from its own; among which you may reckon *gravelly* or *pebbly* ſoils. To theſe it brings the only part of excellence they naturally want, and conſequently changes them, from what they were originally, to an equal fertility with the beſt and richeſt.

This will, perhaps, be ſtrange news to many countrymen, who have bought *dung*, all their life-time, to deſtroy their land with. 'Tis as great a folly, adds our author, to *dung* grounds which require *cooling*, as 'twould be thought to adminiſter *poiſon*, to cure a man of a *fever*. Our farmers are not ſenſible, that the *temper* of the *land* muſt, as neceſſarily, be conſulted, as the *pulſe* of the *patient*. The dunghil only is their univerſal refuge; they fly to *that* upon all occaſions. They miſs a crop, by dunging an improper ſoil; and lay on more dung, to remedy the misfortune.

Some few years ago, continues he, a friend of mine remarkably experienced the ſufficiency of this obſervation. He had a couple of fields, divided by a hedge only; neither of which was fit for corn, or feeding. He reſolved to improve them both: and when they were plowed up to that intent, he found, that one was a hard brown *clay*, and the other a very burning *gravel*. He was ſurpriſed to find theſe diametrical oppoſites ſuch neighbours, and ſuppoſed that, for that reaſon, the hedge had been formerly made to ſeparate them. He pulled down the diviſion, and, having laid them open, ſet his men to work on trenching them ſix inches deep. The earth they dug out of one trench in one field, he made them carry inſtantly to another trench in the other field, in wheel-barrows; by this means interchangeably mingling the *gravel* with the *clay*, and the *clay* with the *gravel*.——When this was done, he had it plow'd all over with a deep cutting plow, and has ſow'd it every ſeaſon ſince with the richeſt grains. The effect of this is, that he has not now a finer or more mellow piece of ground in his eſtate. The very *nature* of the land is altered, and there remains no viſible difference between the two diviſions, but the whole is converted into a good *hazel-mould*, and produces a plump round corn, and as plentiful harveſts as any ſoil in the kingdom.

The practice of the North-Riding of Yorkſhire, as related by Dr. Liſter, *Phil. Tranſact.* No. 225. ſhews to how great advantage clay is made uſe of there, as a manure. The clay is of a blueiſh colour, not ſandy at all, but very ponderous. They dry it about Midſummer, on the declivity of a hill, and lay 100 loads on an acre of ground of a light ſandy ſoil. They obſerve, that for three or four years it continues yet in clods upon the land; and that the firſt year, the land ſo manured bears rank ill-coloured and broad-grain'd barley, but afterwards a plump round corn like wheat. This clay manuring will, by certain experience, laſt above forty years in the ground, and then it muſt be clayed again. This ſandy ground, unleſs clayed, will bear nothing but rye, whatever other manure they uſe.

Clay becomes a much better manure when mixed with lime, than perhaps either of them are ſingly. The lime corrects the bad qualities of the clay, by rendering it more friable.

Sea-owſe, that is, the ſettling of the tides on ſhores and level places, between low and high-water mark, is a manure of incomparable excellence for many ſorts of lands; but is, on others, to be avoided, as a certain bane to whatever part 'tis mixed with. Looſe ſandy ſoils are peculiarly benefited by it.

The cleaning of ponds and ditches becomes likewiſe here an excellent manure, conſiſting of the putrified animal and vegetable bodies mixed with the rich earth depoſited there by rains, &c. The ſame may be ſaid of the mud in rivers, where, by the ſtag-

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nating, or want of current in the water, the rich particles carried down by it have time to ſubſide.

But of all the manures for ſandy ſoils, none is ſo good as *marle*. There are many different kinds and colours of it, ſeverally diſtinguiſhed by many writers; but their virtue is the ſame; and they may all be uſed upon the ſame ground, without the ſmalleſt difference in their effect.

The colour is, either *red*, *brown*, *yellow*, *blue*, *grey*, or *mix'd*. It is to be known by its pure and un-compounded nature. There are many marks to diſtinguiſh it by; ſuch as its breaking into little ſquare bits; its falling eaſily to pieces, by the force of a blow, or upon being expoſed to the ſun, and the froſt; its feeling fat and oily, and ſhining when 'tis dry.——But the moſt unerring way to judge of marle, and know it from any other ſubſtance, which may appear like it, is, to break a piece as big as a large nutmeg, and, when 'tis quite dry, drop it to the bottom of a glaſs of clear water, where, if it be right, it will diſſolve and crumble, as it were to duſt, in a very little time, ſhooting up many ſparkles to the ſurface of the water.

In many places, marle diſcovers itſelf to the moſt negligent eye; eſpecially upon the ſides of broken hills, or deep hollow roads, in moſt counties in England. Many rivers poſſeſs an inconceivable treaſure, on both their ſides, which is plunder'd by every flood. *Boggy lands* frequently cover it; and, in ſuch, it ſeldom lies above three feet deep. 'Tis ſomewhat lower, under ſtiff clays, and *marſhy level grounds*. Moſt *ſandy* lands abound in it, in their loweſt places, at ſometimes three feet depth, and ſometimes ſeven, nine, or more. As for the marle itſelf, 'tis ſeldom you can find its depth; for, when the upper cruſt of the earth is once removed, all you can ſee, or dig, is marle, as deep as ever you can go. There are few, if any, inſtances of a marle-pit's being exhauſted.

Nothing is more common, in moſt places, than to find the ditches which incloſe a field, dug down ſo deep that they have penetrated ſix or ſeven inches into a bed of marle that lies under them, without the farmer's taking any notice of it, tho' the prodigious ſhooting and increaſe of the graſs which is put forth by the marle thrown up upon the ſides of the bank, might, one would think, be a means of diſcovering it. Where the marle is thus, by accident, diſcloſed, it not only turfs the ſides and tops of the banks, and thereby ſecures them againſt all injuries of weather, but makes the graſs grow to ſuch ſurprizing length and thickneſs, that, when beaten down by winds, it hangs along as if it thatch'd the earth which nouriſh'd it, and carries off the rain, without permitting any conſiderable quantity to enter through it.

The author of the *New Syſtem of Agriculture*, p. 118. recommends, as a very eaſy and infallible method of diſcovering whether there is any marle in places it may be thought to lie under, to have three augers made, of near an inch diameter, with an iron handle fix'd croſs-wiſe to each; the bitts of theſe augers to be pretty large, and tenacious of what they pierce. One of them may be three feet long, the ſecond ſix, and the third ten. When you would try the place you have hopes from, carry thither theſe augers, and let a ſervant take the firſt, and wring it into the earth, by twiſting at each end of the handle. He muſt draw it out as often as it has pierced a new depth of ſix inches, to cleanſe and examine the bitt, and obſerve what he draws up in it.———If you find nothing but common earth within the reach of this firſt auger, let him thruſt the ſecond down the hole which was made by the former, and proceed in the ſame manner, till he has wrung this alſo up to its handle; and then let him do the ſame by the third auger; always remembering to examine the auger bitt after each new progreſs of ſix inches.

By this means you will certainly, and without charge or hazard, diſcover not only what marle is under your ſoil, but whether any other thing of value lies concealed there, ſuch as chalk, coals, fuller's earth, or quarries of ſtone, many of which are hid, and quite unthought of, in places where their value, was it known, is ten times more than that of the whole eſtate which covers them.

Our author relates on this occaſion, a ſtory of a Dutchman who was caſt away upon the coaſt of Norfolk, and carried before a juſtice of peace, who, underſtanding that he had ſkill in *draining*, took him one morning into a field in which he had begun a work of that nature. The Dutchman perceived a whitiſh kind of earth, which had been caſt out of one of the trenches, and examined it with more than ordinary earneſtneſs. The juſtice aſked him, if it were of any value in Holland? The ſailor anſwered, that it was ſold in his country at an extraordinary rate; that it came to Delft, and other places, down the Rhine, from a little village about twenty miles above Frankfort, and was uſed for making the fineſt ſort of earthen-ware. The juſtice thereupon ſent a ſample of it to Holland, and finding the

the matter exactly as it had been reprefented, became a merchant of this product of his own land, and in a few years got ten thoufand pounds by it.

Though, as was obferved before, there is fcarce any fuch thing as exhaufting a marle-pit, there is however, now and then, an inconveniency attending fuch as dig too deep in level lands inclineable to wetnefs in the winter: for the fprings will fometimes break in upon your pit, and much increafe the labour of your workmen, and your own expences. There are little engines to be made, which, turning in a femi-circular frame, will catch the wind at every point, and, by the force of their motion, pump up vaft quantities of water, and, by that means, eafe this inconvenience, which, however, had much better be prevented; and that may infallibly be done, by working wide and fhallow, in fuch places, as you fufpect to be watry.

This author feems never to have feen fhell-marle, by his not mentioning it. It is often found under mofs, or that black earth ufually dug up for fewel, or where there has been a bed of a river or running water; the fhells in it having, probably, belonged formerly to fome living creatures. Whoever finds this marle, finds a mine of great value. It is one of the beft and moft general manures in nature. It is proper for all foils, and peculiarly fo for clay, as already obferved. This effervefces ftrongly with all acids, which is perhaps chiefly owing to the fhells. There are very good marles which fhew nothing of this effervefcence: and therefore the above author judged right, in making its folution in water, the diftinguifhing mark.

The fame writer, fpeaking of the quantity of manure proper to be laid upon light fandy foils, whether it be *chalk*, *marle*, *clay*, *fheep's dung* prepar'd with *earth*, not *fand*; *fea-owfe*, of the clofeft, black, fat kind, *mud*, or the product of your *ftercorary*, fays, five and twenty load of the laft is the quantity moft proper; thirty of chalk; of marle, at leaft an hundred; and of clay, a little more: twenty load of fheep's dung, and as much of fea-owfe; and, if you ufe mud, lefs than forty or fifty load will be too little. Whichever of thefe manures is ufed, care fhould be taken that the plowman turns it in, as faft as it is brought on, and fpread upon the furface.

I cannot difmifs this article without mentioning an obfervation made by an ingenious gentleman, on reading Pliny's account (c. 6) of the ufe of marle in Britain, by the Romans.——It may be worth while to obferve, fays he, that Pliny is very particular on the ftate

of

of agriculture in Britain in his days; and whoever will be at the pains to read what he ſays on that head, will have ſufficient reaſon to think, that, we are ſtill far below the point, to which the Romans had then brought it in this iſland. And this, I believe, cannot be ſaid of any other art or ſcience, which, like this, is independent of what is called genius, or of the powers of the imagination. In all others of this kind, we excell, not only our neighbours, but every nation that has gone before us; men of every rank and order lending a helping hand to forward and improve this art, or that ſcience. But agriculture, which was the favourite employment of the greateſt Roman ſenator, in his retreat from buſineſs, has (till of late) with us been left to the feeble efforts of the poor and illiterate peaſant. What elſe, for example, but their groſs ignorance and inattention, can account for the neglect of uſing marle in the improvement of particular ſoils? Pliny ſpeaks of it as a particular ſpecies of improvement, which obtained in Britain and Gaul. He calls it the fat of the earth, and compares it to the glands in the human body, which are lapped in a coat of fat. And as this practice (as it would ſeem) had no place in Italy, it ſhews how attentive the Romans were to agriculture, wherever their arms carried them, that in ſpite of the continual alarms they lived in from the natives here and in Gaul, yet they found time to diſcover and perfect a ſpecies of improvement in a particular manner ſuited to the ſoil and climate, and, of all others, the cheapeſt and moſt laſting.

I muſt farther obſerve, with Dr. Home, that there is a body very ſimilar to marle in its appearance, but very different from it in its effects, and often found in the ſame bed with the beſt marle. It is of a darkiſh lead colour. Inſtead of fertilizing the ground, it renders the beſt ſoils incapable of bearing any kind of vegetables for many years. I have ſeen the ſpots on which it was laid, entirely barren three years after. I have heard of its effects continuing in other places for a much longer time; nor is it certainly known when its bad effects will end. A body ſo very deſtructive to agriculture, deſerves to be well characteriſed, in order to be ſhnnned; and well examined, that we may know whence proceeds this noxious quality, and how to cure it when it has taken place.

Marle takes a ſmooth poliſh from the inſtruments with which it is wrought. A piece of this taken up, which has not been much expoſed to the influence of the air, differs greatly in taſte, from marle. Inſtead of the ſmooth unctuous taſte of the latter, it is acid, and remarkably

markably aſtringent. It agrees with marle, in crumbling in water; but then it differs remarkably from it, in raiſing no efferveſcence with acids, nor in the leaſt deſtroying their acidity. It turns the ſyrup of violets red; which ſhews that it contains an acid: whereas marle, like all abſorbent earth, gives it a green colour.

It appears from experiments made by the doctor, that this ſubſtance conſiſts of an earthy body like clay, about one eighteenth part of ſalt of ſteel, and a ſmall proportion of the vitriolic acid: and he concludes, that marle is the proper cure where this noxious earth has been inadvertently uſed, becauſe it corrects the acid, and decompoſes the ſalt.

III. *Of Loam.*

LOAM, being free from the too great ſtiffneſs of clay, and the too little coheſion of ſand, in order to its due culture, ſeems only to ſtand in need of being kept in good tilth, and ſupplied at proper ſeaſons with ſuch ſubſtances as the experience of ages has ſhewn to contain in them matter fit for the nouriſhment of plants, or at leaſt to be endued with the power of rendering the earth fruitful. Such ſubſtances we ſhall therefore call general manures. Of theſe, dungs of all kinds, putrid, vegetable and animal ſubſtances, aſhes of vegetables, and even of ſea-coal and peat, ſoot, and lime, are the chief.

Dungs, as Mr. Miller obſerves, are deſigned to repair the decays of exhauſted worn-out lands, and to cure the defects of land, which are as various in their qualities as the dungs are, that are uſed to meliorate and reſtore them. Some lands abound too much in coldneſs, moiſture, and heavineſs; others again are too light and dry; and ſo, to anſwer this, ſome dungs are hot and light, as that of ſheep, horſes, pigeons, &c. others again are fat and cooling, as that of oxen, cows, hogs, &c. And as the remedies that are to be uſed, muſt be contrary to the diſtempers they are to cure; ſo the dung of oxen, cows, and hogs, muſt be given to lean, dry, light earths, to make them fatter and cloſer; and hot and dry dungs to meliorate cold, moiſt, and heavy lands.

There are, continues he, two peculiar properties in dung: the one is to produce a certain ſenſible heat, capable of producing ſome conſiderable effect, which properties are ſeldom found but in the dung of horſes and mules, while it is newly made, and a little moiſt: the other property of dung is, to fatten the earth, and render it more fruitful.

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The dung of horſes and mules is an admirable fertilizer: but care muſt be taken not to lay too much of it on corn lands, becauſe it produces abundance of ſtraw.

Horſe-dung, being of a very hot nature, is beſt for cold lands, and cow dung for hot lands; and being mixed together, may make a very good manure for moſt ſorts of ſoils, and for ſome they may be mixed with earth.

The dung of pigeons and fowls is ſo rich, that it is generally uſed for a dreſſing to plants whilſt they are growing. That of pigeons, ſays Mr. Miller, is the beſt ſuperficial improvement that can be laid on meadow or corn land: but before it is uſed, it ought to have lain abroad out of the dove-houſe ſome time, that the air may have a little ſweetened it, and mollified the fiery heat that is in theſe dungs.

The dung of poultry being hot and full of ſalts, tends much to facilitate vegetation: and is abundantly quicker in its operation, than the dung of animals which feed on herbs.

To animal ſubſtances belong all parts of their bodies, as fleſh, blood, ſhavings of bones, hoofs, rags of their wool or hair, &c.

Mr. Evelyn ſays, the blood and fleſh of animals is much more powerful for the enriching of land, than their dung and excrements, and is computed at twenty times the advantage; and to the ſame advance above this, is hair and calcined bones. Woollen rags are peculiarly uſeful for light ſoils. They ſhould be chopt ſmall, about an inch or two ſquare, and ſcattered on the earth at the ſecond plowing; for being thereby covered, they will begin to rot by ſeed time. They imbibe the moiſture of dews and rain, and retain it long; and, as Dr. Home obſerves, thereby keep light ſoils in a moiſt ſtate. The ſame may be ſaid of the hoofs of cattle, when ſet upright in the earth, as Mr. Ellis directs. They hold the rain that drops into them, and it putrifies there, till, being worked out by ſucceding ſhowers, it falls upon the ſurrounding earth, and communicates a great fertility to it. —Sea-ſhells may likewiſe be included under this head: but we have already ſpoken of them, in the article *Clay*.

Vegetables afford great abundance of excellent manure. The cuſtom of plowing in green ſucculent plants, is very ancient. All the Roman authors ſpeak of it particularly. Buck wheat and vetches are the two plants moſt frequently ſown in England for that purpoſe; and the time of plowing them in, is when they are in bloom, being then in their moſt ſucculent ſtate. Some farmers plow in their ſecond crop of clover, to enrich the land for wheat in the autumn.

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This ſhould be done early enough to give the plants ſufficient time to putrify thoroughly before the grain is ſowed: otherwiſe it might prove prejudicial, by bringing on a heat which would hurt the corn. Sea-weeds of all ſorts are a moſt profitable manure to be plowed in.

Rotten vegetables of moſt ſorts, ſays Mr. Miller, greatly enrich land: ſo that, where other manure is ſcarce, theſe may be uſed with great ſucceſs. The weeds of ponds, lakes, or ditches, being dragged out before they ſeed, and laid on heaps to rot, will make excellent manure; as will moſt other ſorts of weeds. But wherever any of theſe are employed, they ſhould be cut down as ſoon as they begin to flower: for if they are ſuffered to ſtand until their ſeeds are ripe, the land will be ſtored with weeds, which cannot be deſtroyed in two or three years; nay, ſome kind of weeds, if they are permitted to ſtand ſo long as to form their ſeed, will perfect them after they are cut down, which may be equally prejudicial to the land: therefore the ſureſt way is to cut them down juſt as they begin to flower; at which time moſt ſorts of vegetables are in their greateſt vigour, being then ſtronger and fuller of juice, than when their ſeeds are farther advanced: ſo that at that time they abound moſt with ſalts, and therefore are more proper for the intended purpoſe. In rotting theſe vegetables, it will be proper to mix ſome earth, mud, or any other ſuch like ſubſtances with them, to prevent their taking fire in their fermentation; which they are very ſubject to, when they are laid in large heaps, without any other mixture to prevent it: and it will be proper to cover the heaps over with earth, mud, or dung, to detain the ſalts; otherwiſe many of the finer particles will evaporate in fermenting. When theſe vegetables are thoroughly rotted, they will form a ſolid maſs, which will cut like butter, and be very full of oil, which will greatly enrich the land.

Another manure, greatly, and very properly recommended by this gentleman, is rotten tanner's bark. Oak-bark, ſays he, after the tanners have uſed it for tanning of leather, when laid in a heap, and rotted, is an excellent manure, eſpecially for ſtiff cold land; in which one load of this manure will improve the ground more, and laſt longer, than two loads of the richeſt dungs. It is better for cold ſtrong land, than for light hot ground, becauſe it is of a warm nature, and will looſen and ſeparate the earth; ſo that where this manure has been uſed three or four times, it hath made the land very looſe, which before was ſtrong, and not eaſy to be wrought. When this manure is laid on graſs, it ſhould be done ſoon after

Michaelmas, that the winter rains may waſh it into the ground: for if it is laid on in the ſpring, it will burn the graſs, and, inſtead of improving it, will greatly injure it for that ſeaſon. Where it is uſed for corn land, it ſhould be ſpread on the ſurface before the laſt plowing, that it may be turned down for the fibres of the corn to reach it in the ſpring; for if it lies too near the ſurface, it will forward the growth of corn in winter; but in the ſpring, when the nouriſhment is chiefly wanted to encourage the ſtems, it will be nearly conſumed, and the corn will receive little advantage from it.

Aſhes of all green vegetables contain an alkaline ſalt, of great uſe as a manure, but eaſily diſſolved in water, and carried off. Greater care ſhould therefore be taken to keep ſuch aſhes covered from the air, till uſed.

Peat-aſhes are likewiſe of great ſervice. We ſhall here give Mr. Ellis's account of this manure in his own words, vol. II. p. 68. "If barley, ſays he, is ſown ſo late as the beginning of May, lean peat-aſhes in particular may be applied over it, or harrowed in with the grain: but aſhes burnt from fat black peat, ſuch as they dig at Newbury, are of ſuch a ſulphurous nature, that they are afraid to lay them on their barley; and they do not dreſs their wheat with them till the ſpring is advanced, and then they are ſown over it.——The great uſe of theſe aſhes was found out about thirty (now fifty) years ago: but in a little time after they were brought into diſreputation, by their imprudently laying on too many at a time, which burnt up the corn. Afterwards they found that ſix or ten buſhels were ſufficient to be ſown over an acre of wheat, peaſe, turneps, clover, rape-ſeed, or *St. Foyne*, as early as they conveniently could. But, as I ſaid before, they are afraid to ſow it over barley, leſt a dry time ſhould enſue, and burn it up; for theſe aſhes are reckoned to contain three times as much ſulphur in them, as there is in coal-aſhes; and this they reaſonably imagine from their great brimſtone ſmell; ſparkling and jumping, when they are ſtirred as they are burning, and drying up the corn by their too great heat. Theſe peat-aſhes, and likewiſe thoſe from wood or coal, will help to keep off the ſlug from peaſe and other grains, by the ſalt and ſulphur contained in them, and very much conduce to their preſervation in cold wet ſeaſons. But there is no ſuch danger to be feared from the aſhes of that peat, which grows as a turf over ſandy bottoms, as great quantities do on Leighton-heath in Bedfordſhire; for theſe are as much too lean, as the others are too rank."

Soot, either of vegetables or of coal, is reckoned a good improver of cold and moiſt grounds. Many find their account in ſtrewing it early over their green wheat and barley: but Mr. Ellis ſays, neither of them ought by any means to be ſooted after the 25th of April, becauſe the wheat, and generally the barley, have then done gathering and branching, and are upon the ſpindle. He thinks it likewiſe proper to be ſown over young turneps, that have all juſt appeared. Care ſhould be taken not to ſtrew it too thick; for otherwiſe its hot nature might hurt the plants.

Malt-duſt is a good manure for poor clayey lands; and will oftentimes go farther than dung. It is moſt beneficial when rain falls upon it ſoon after its being ſtrewed, and waſhes it into the earth before it has loſt its ſtrength. In ſome parts of Berkſhire, they lay the malt-duſt on at the ſame time that they ſow the wheat, and harrow them both in together. This they find turn to good account. Some huſbandmen hold it to be better for ſummer corn, than for wheat, and the reaſon they aſſign is, that the winter corn lies a whole year in the ground, and the malt duſt will have ſpent its ſtrength by the time the winter is over, and not hold up the corn in heart all the ſummer. They ſow with the wheat two quarters of malt-duſt to an acre, which makes four quarters of corn meaſure.

This manure is likewiſe a great improvement to cold graſs-grounds.

All ſorts of fern, ſtraw, brake, ſtubble, ruſhes, thiſtles, leaves of trees, or any manner of vegetable traſh whatever, ſays Mr. Worlidge, either caſt into the yards amongſt the cattle or ſwine, or caſt into pools or places to rot in, or mixed with other ſoils, help very much, and make very good compoſt. The lees of wine and the grounds and ſettlings of beer, ale, &c. have the ſame effect.

Chalk is a laſting manure for lands that it agrees with. Pliny tells us it was the cuſtom of the Britons to chalk their lands, by which, ſays he, they received a great improvement, which laſted their lives.

It is a general ſaying, that chalking is better for the father than the ſon; but experience often ſhews it to be as good an improvement as dung, for twenty years together: and that clay land has been always the better for it.

There are ſeveral ſorts of chalk: ſome of ſo hard and indiſſoluble a nature, that it is not fit to lay on lands ſimply as it is, but after it is burnt into *lime*, it becomes an excellent improver. Other ſorts of chalk, more unctuous and ſoluble, being laid on lands crude as they are, and let lie till the froſts and rain ſhatter and diſſolve them, prove a very confiderable advantage to barren lands.——Where any of thefe chalks are found, Mr. Worlidge advifes proving their natures, by laying them on fome fmall portion of land, crude as they are, or by burning them into lime, if fewel be plenty, or to half-burn them; by which, fays he, you may experimentally know the true effects and benefits that fubject will yield.——And although, continues he, *chalk*, fimply of itfelf, either burnt or unburnt, may not prove fo advantageous as many have reported, yet it is of very great ufe to be mixed with earth and the dungs of animals, by which may be made an admirable, fure, and natural fruitful compofition for almoft any fort of lands, and raifeth corn in abundance.

Chalk ought never to be plowed in, either too foon or too deep. It fhould have time to crack and wafte on the furface of the earth, and not be turned down to the bottom of the furrow, left it fhould fubfide there in a mafs, and not be ftirred by fubfequent plowings. Twelve or fourteen loads upon an acre will make fome lands produce extraordinary crops of corn for fourteen or fifteen years together.——In the Ifle of Wight, they fometimes lay twenty-five waggon-loads of it on an acre. Their chalk is of a fat foapy kind, and they call it marle. The farmers in the hundreds of Effex bring their chalk as far as from Gravefend, but lay not half fo much on an acre, as thofe of the Ifle of Wight.——It fhould always be fpread as foon as poffible after it is dug, becaufe it is apt to harden and grow ftoney in the air.

Mr. Worlidge fays, you may deal with chalky land as with clay land, though in a moderate way: for chalky land is naturally cold, and therefore requires warm applications. It is alfo fad, and will therefore the better bear with light compofts; which is the reafon that chalk is fo great an improver of light, hot and dry grounds, efpecially after it has fuffered a calcination.

If chalk be laid on clay, fays Mr. Lifle, vol. I. p. 66. it will in time be loft, and the ground again return to its clay: and if clay be laid on chalk, in time the clay will be loft, and the ground return again to its chalky fubftance. Many people, continues he, think the land on which the other is laid for a manure, being predominant, converts the manure into its own foil: but I conceive in both cafes the chalk and clay is, in time, filtrated through the land on which 'tis laid, and being foluble by rain into fmall corpufcles, is wafhed thro' the land on which 'tis laid; for neither of thefe manures is able to unite in its fineft corpufcles, with the corpufcles of the land on which it is is laid, ſo as to make ſo ſtrict an union and texture with it as the land doth with itſelf, and is therefore liable to be borne downwards with rains, till no ſign of it be left.

Chalk, laid upon meadows, will enable them to give a great crop for three or four years, but it is thought afterwards to impoveriſh them.———Mr. Liſle is of opinion, that the contrary is the caſe with reſpect to paſture lands: becauſe the graſs being thereby greatly ſweetened and increaſed, keeps conſtantly ſo much the more ſtock, by which it is maintained always in the ſame vigour.

The ſame gentleman aſſigns the following reaſons, why chalk is good for ſandy and clayey ſoils. "I do ſuppoſe, ſays he, that chalk, "laid on ſandy or wood-ſeary ground laid up for paſture, may waſh "and ſink in, and fill up the interſtices, and thereby conſolidate and "mend the texture of ſuch ground, and ſweeten it, as it is a great "alkali: and tho' by time moſt of the chalk may be waſhed down-"wards, ſo that the ground may loſe the virtue, yet I do ſup-"poſe the ſtrength of the ground may ſtill continue much the "better, by reaſon that ſuch manure having made the ſword of "the graſs come thicker and ſweeter, the good paſturage on both "accounts enlarges the quantity, and betters the quality of the dung "the cattle leave on it, which in return maintains a better coat and "ſurface to the ground: and as chalk fills up the vacuities of ſandy "or wood-ſeary ground, ſo on the contrary, it inſinuates its particles "into obſtinate clayey and ſtrong land, and divides it, by making "in a manner a ſciſſure, thereby hollowing and mellowing it; ſo "that the two contrary extreams are cured by chalk."

As *loam* may be inclined either to *clay* or *ſand*, the huſbandman may collect his manure accordingly, either of dry opening ingredients, ſuch as aſhes, lime, dung of ſheep and horſes, rubbiſh of old houſes, *&c.* for the former; or of things which give coheſion and fatneſs, ſuch as dung of cows and hogs, putrid, animal and vegetable ſubſtances, marle, *&c.* for the latter.

Our farmers, collecting the manures they find neceſſary from time to time, as they come to hand, generally heap them together in what they call dung-hills. Theſe dung-hills ſhould be placed where there are no running waters or ſprings, that their rich juices may not be waſhed away. They are greatly negligent in this care. Mr. Evelyn, and the author of the *New Syſtem of Agriculture*, call theſe aggregates of compoſts *ſtercoraries.* Such ſhould by no means have a communication with any of the offices, as adviſed by the latter; for the

the vapours arising from the putrid dung, must prove hurtful to the health of horses or other cattle exposed to it in a confined place. Mr. Evelyn disapproves of laying dung in heaps in the field, exposed to the sun, rain, and drying winds, whereby all its spirit and strength is carried away; and advises the following, as a better method of managing our dung-hills, or *stercoraries.*——Let the bottom or sides of a pit, says he, be about four feet deep, paved with small chalk or clay at the bottom, that it may hold water like a cistern: direct your channels and gutters about your house and stables to it. The pit must be under covert, so that the down-right rains may not fall into it. Lay a bed of dung in it a foot thick, on that a bed of fine mould, on that another bed of cyder-mere, rotten fruit, and garden offal, on this a couch of pigeons and poultry dung, with more litter, and beds of all variety of soil, and upon all this cast water plentifully from time to time.

The directions of the author of the *New System of Agriculture,* for making a *stercorary,* and which we much approve of, barring its being so near the stable as he seems to intend it, are as follow.

"Along the back of your stable cause a pit to be dug, to the depth of the foundation, or a pretty deal below it: let it be as long as the stable, but its breadth should be according to the quantity of dung you have conveniencies for making: let this pit be arch'd with brick, but very slightly, and an entrance left at one end, which may be shut up, or open'd, by a wooden door: let the sides and bottom be firmly lin'd with stone, and closely plaister'd over with a cement, which will by no means admit moisture.

Through the wall of this stable, and about a foot or more from the ground, let there be made square holes, which, opening into the stercorary, from within the stable, must be of sufficient largeness for the passage of the dung, that is, from time to time, to be shovell'd through them.

The stable floor should be made as smooth and hard as possible, that the urine of the horses may not soak into it, but descending from them to a little gutter, close along the wall, thence run through passages, which are purposely to be made, into the stercorary.

Pipes of earth, which cost but little, should be laid, from this place, to the cow-house, hog-sties, and privies, that all urine of man or beast, of any kind whatsoever, may immediately be convey'd

to

to mingle with the other. Into which muſt be caſt all ox dung, cow dung, hogs dung, and dung of fowls; all aſhes, whether of wood, or ſea-coal; the duſt and ſweepings of your yard and houſe; all weeds, old litter, rotten ſtraw, and ſpare earth, which you can get; as alſo the waſhing of barrels, all ſoap-ſuds, water which meat has been boil'd in, diſh-water, and every ſuch kind of thing, which is now thrown down the common ſink, and render'd uſeleſs: and for the more convenient performance of all this, there may be left a pretty large ſquare hole, in the outward declivity of the arch which covers the ſtercorary. This hole muſt have a wooden door fitted to it, which, lifting up and down, will, as occaſion offers, not only ſerve for taking in the things above named, but, whenever more moiſture may be thought wanting, it will admit as much as is convenient, by being left open in rainy weather, and, as ſoon as ſhut, forbid the entrance of any more. The other door, which I ſpoke of, in one of the ends, is only to ſerve for carrying out the dung, when it is to be made uſe of.

In ſuch a ſtercorary as is here deſcribed, the charge is a trifle, not worth naming, in compariſon with the profit. The dungs and other things, incorporating, and fermenting thus together, mellowed, and enriched by the ſpirit of the urine, and unimpaired by the ſun, rain, or wind, attain an excellence, which is beſt known by the prodigious increaſe they make in your crops; and which demonſtratively proves, that one load thus managed, is of more effect than twenty after the common manner."

We leave to experience to determine, whether a ſtercorary with only a ſhade thrown over it, would not nearly anſwer all the ends propoſed by cloſing it up, and have none of the dangers attending the other.

The method of making *lime* is ſufficiently known. It's uſe and application, as a manure, is all that appertains to our ſubject.

Liming of land, ſays the author of the *Engliſh Improver*, is of moſt excellent uſe; many barren parts of this kingdom being thereby brought to ſo fertile a condition for bearing moſt ſorts of grain, that as good wheat, barley, and peaſe, as England yields, has, with the help of that manure properly diſtributed, been raiſed upon land, before not worth above a ſhilling or two an acre. He adds, that twelve or fourteen quarters will lime an acre. Another writer ſays 160 buſhels. The difference of the land may require a different proportion.

The

The moſt natural land for lime, ſays Mr. Worlidge, is the light and ſandy; the next, mixt and gravelly: wet and cold gravel is not good, and cold clay is the worſt of all.

A mixture of lime, earth, and dung, together, adds he, is a very excellent compoſt for land.

Mr. Evelyn adviſes, for lands that want heat, to mix *lime* with *turf* and *ſwarth*, laying them alternatively, turf on lime, and lime on turf, in heaps, for ſix months, by which means it will become ſo mellow, and rich in nitrous ſalts, as to diſſolve and run like aſhes, and carry a much more cheriſhing vigour, than if uſed alone in a greater quantity, and without danger of burning out and exhauſting the vegetative virtue which it ſhould preſerve.

Lime, a little ſlack'd, continues he, is excellent for cold wet grounds and ſtiff clays, but it over-burns drier ſoils. It is the very deſtroyer of moſs and ruſhes, as quick-lime is of furzes, being firſt extirpated.

Mr. Liſle thinks it is beſt, eſpecially in lands that work mellow, to ſpread and plow the lime in as ſoon as it is ſlacked, rather than to let it lie long covered with the earth in heaps.

Chalk-lime is not, in his opinion, ſo beneficial to land, as ſtone-lime; becauſe a greater virtue muſt be attributed to the ſtone-lime for its burning quality after it is laid on.

Lime, being laid on meadows or paſtures, ſlacks and cools by ſlow degrees, ſo as not to undergo ſuch a heat and fermentation, as when it is covered with the hillocks of earth flung up in arable; therefore, ſays he, it cannot be of that great advantage to paſture.

The lighter the land is, the more lime it will require: the ſtronger, the leſs. In ſome places they lay twenty-four or thirty quarters on an acre. The nature of the ſoil muſt determine the proper quantity.

In Leiceſterſhire they ſow or ſcatter the lime on wheat-land when they ſow the wheat, but on barley-land the laſt earth but one; and ſo plow it in, leſt, if they ſhould ſow it with the barley in the ſpring, it might burn it. They lay five quarters to an acre of each, according to the meaſure as it comes from the kiln, for after it is ſlack'd thoſe five quarters will make near ten.

As the intent of liming land, is to bind it, Mr. Liſle thinks it ſhould not be limed late in the year, becauſe the land being then cold and moiſt, and but a weak ſun to conſolidate it, the deſign of liming

liming is frustrated; for if it does not consolidate at first liming, it will not afterwards.

In Shropshire they lay dung and lime together, *viz.* about twenty load of dung, and only twenty bushels of lime on an acre.

Mr. Lisle gives it as a rule to all husbandmen, to be cautious of liming ground, and then plowing out the heart of it. I limed, says he, some years ago, in Wiltshire, seven acres for an experiment, and laid down one acre to its own natural grass in two years time, the grass of which is to this day 40 shillings an acre. The third year I laid down another acre, which is to this day worth 30 shillings per acre. The rest I plowed five or six years farther, which is not worth fifteen groats per acre. The like experience, adds he, I have had in burn-beaking ground.

We shall now give our author, Mr. Duhamel's account of liming, as practised in the lower Normandy.

Lime is used there chiefly on fresh broke up lands. After having plowed them up, not very deep, they lay on the lime in the following manner.

They carry on the lime as it comes from the kiln, and lay about one hundred pound weight in a heap on every square perch, so that the heaps lie at a perch distance from one another. Then they raise the earth all round the heaps, like so many basons: the earth that forms the sides of these basons, should be a foot thick: and lastly, they cover the heaps, half a foot thick, with earth, in form of a dome. The lime slacks under this covering of earth, and is reduced to powder: but then it increases in bulk, and cracks the covering of earth. If you do not carefully stop these cracks, the rain will get through them, and reduce the lime into a paste which will not mix with the earth, or make a sort of mortar which will not answer the end proposed. The farmers are therefore very careful to examine the heaps from time to time, and stop the cracks. Some only press the top of the heaps with the back of a shovel: but this practice is subject to an inconvenience, for if the lime is in a paste within the heap, by this means you beat it so together that it will not easily mix with the earth; for which reason it is better to stop the chinks by throwing some fresh earth over the heap.

When the lime is thoroughly slack'd, and reduced to powder, they cut the heaps with a shovel, and mix the lime as well as possible with the earth that covered it, and then, throwing it up in heaps again, leave it expoſed to the air for ſix weeks or two months; for then the rain will do no harm.

About the month of June, they ſpread this mixture of lime and earth upon the land; but not by throwing it about unequally, and at random: on the contrary, they take it up by ſhovelfuls, and diſtribute it in little heaps at equal diſtances on each perch of land: they obſerve that theſe little heaps promote vegetation, more than if it was ſpread uniformly all over the field, and they don't mind leaving little intervals unlimed between each ſhovelful. They afterwards plow the field, for the laſt time, very deep: then, towards the end of June, they ſow buck-wheat, and cover it with the harrow; and if any clods remain, break them with a hoe.

Buck-wheat occupies the land about an hundred days; ſo that this grain ſown about the end of June, is gathered about the end of September.

When the ſtalks and roots of this plant are dead and dried, they plow them up, and immediately ſow wheat, and cover it with the harrow.

About the month of July or Auguſt, after the wheat crop, they plow as ſoon as poſſible: they plow for the laſt time in February or March, in order to ſow oats, or in April for barley; but in this caſe they ſtir the land two or three times to make it fine.

They harrow in all theſe different grains, and when they are come up, they paſs a roller over the oats, and if there remain any clods in the barley, they break them with a hoe.

The next February or March, they plow the land again, in order to ſow it with grey peas or vetches.

After theſe pulſe have been reaped, they give one or two plowings, to prepare the land for wheat the enſuing autumn.

The year after, they ſow oats, mixt ſometimes with a little clover, and then lay it down to paſture for three or four years.

In ſome new broke up lands they ſow no buck-wheat, but let it lie fallow from the month of March, when it was firſt broken up, till October, when they ſow it with wheat; making uſe of the intermediate time to give it ſeveral plowings: theſe lands being by this means much finer, they uſe little more than three-fourths of the quantity of lime above preſcribed, and generally have a better crop than when they begin with buck-wheat.

Some farmers think a perch too great a diſtance for the convenience of ſpreading the lime; therefore they make the heaps leſs, and increaſe

increaſe the number in proportion. Being perſuaded that lime is moſt efficacious when it lies ſhallow in the ground, they firſt plow it in, and then give it a ſecond plowing before they ſow, which brings it up again near the ſurface.

Others lay the lime in a ridge from one end of the field to the other; which makes it eaſier for them to ſpread.

Mr. Duhamel relates the following fact, as a farther inſtance of the uſe of lime-ſtone. "The ſtone which is uſed for building "at Deneinvilliers, ſays he, is very hard, and bears poliſhing like "marble. It is intermixed here and there with ſhells, ſome of "which are filled with a kind of oker, and others contain a cryſta-"line ſubſtance. Theſe ſtones are fit to make lime of. Some "workmen who were building about our houſe, cut pieces of this "ſtone upon a graſs plot. When they had done their work, the "rubbiſh was cleared away, and nothing left upon the graſs but the "duſt and very ſmall fragments which had fallen from the ſtones "in cutting them. The year following, the graſs grew ſurpriſingly "thick in all the places where theſe ſtones had been cut, was much "taller and greener than any where elſe, and preſerved its vigour "for ſeveral years. One would ſcarce have thought that ſo hard a "ſtone, reduced to powder, would have produced an effect like "that of marle. The goodneſs of lime, as a manure, is, perhaps, "chiefly owing to the fineneſs of the powder to which the lime-"ſtones are reduced by calcination."

Burning, or, as ſome call it, *burn-beaking* of land, may be reckoned among manures, becauſe it is a very great improvement, and only practiſed upon ſome old paſture, or heathy, ruſhy, broomy, and ſuch like barren grounds, which are conſiderably enriched by it; though, as the author of the *New Syſtem of Agriculture* juſtly remarks, lands ſo improved are, for want of one obſervation, generally ruined, in the common practice of plowing them three or four crops ſucceſſively; by which means their whole fertility is moſt aſſuredly exhauſted, and the ſoil becomes incapable of vegetation, though aſſiſted by the richeſt dung, or other manure, in the world. Nothing but ten or fifteen years repoſe, will reſtore the abuſed vigour of nature; whereas, were theſe grounds ſtrengthened by a little marle, chalk, or dung, between their firſt harveſt and their ſecond feeding, the improvement would be made complete and laſting. No method would be more eaſy; nothing poſſibly more advantageous.

The manner of burning land is generally known to be a paring off the fibrous turf, to a confiderable depth, in a hot feafon, which being made into little hills, rais'd hollow, and at equal diftances, are fet on fire, as foon as they are dry enough to kindle, and fo burnt to a kind of red afhes, and thofe afhes fcatter'd over the whole furface: the ground is then plowed up very fhallow, and the feed immediately fown.

This burning of ground is very coftly, and not a little tedious, becaufe the turf is raifed in a laborious manner, by the force of a man's arms and bofom, pufhing againft a thing they call a *breaft-plow.*———I will prefent you, continues our author, with a much neater invention, and which faves, at leaft, two thirds of the charge.

Let fome fmith in your neighbourhood, who is a ready workman, make a hollow plow-fhare, of a double form, that is, one which rifes with a fharp edge in the middle, from the point to the top, and has a *fin* both ways; which fins muft alfo begin at the point, and fo run back to the fhare end. The dimenfions of this fhare will be two feet broad, from the extreme points of the fins behind; one foot long, and a foot high, fomewhat like a three-edg'd fword, if it were cut off a little above the point. The three fins, or edges, muft be very well fteel'd, and the whole made as thin, and as fmooth, as you can get it done.———Into the hollow of this fhare muft be faftened a light ftrong piece of afh, fharpen'd *forward*, to fit the bofom of the fhare, but *behind*, as fquare and fturdy as may be. Into this laft part muft be fix'd a ftrong piece of wood, like a *lever*; not perpendicular, but fomewhat hanging backward. It muft be about two feet high; and on the upper end, fhould have a crofs ftaff, or other contrivance, to which muft be faften'd the harnefs of fuch cattle as your team confifts of. The handles of the plow, and the *earth-boards* to turn the turf, are alfo fix'd into this fquare head; and there is no other inftruction neceffary for the ufe of this plow; but that, when you begin upon the edge of a field, and turn one turf to the hedge, and the other to the field, the laft will cover one of the breadths you muft take at your coming back, and the point of your fhare muft, therefore, run clofe along the edge of this length of turf; by which means one fide of your plough will raife two lengths, and, throwing back the higheft, lay that uppermoft, which had before lain under. By this one obfervation, you cannot mifs the manner of plowing.

But,

But, as this would only raiſe a long unwieldly *rope* of turf, which it would be neceſſary to cut into many hundred pieces, before it would be fit for *piling*, you will find the following invention of admirable uſe and expedition.

Chuſe the body of a ſhort thick tree; the heavier, and more ſolid, the better: let it be neatly rounded, and work'd into a *roller*, like thoſe that are uſed for leveling barley lands. This roller muſt be hoop'd round, in ſix ſeveral places, each two foot diſtant from another: the hoops muſt be of ſtrong iron, and nail'd very firmly on. ——The middle part of every one of theſe hoops muſt riſe into an edge, to about five or ſix inches above the level of the hoop itſelf: theſe edges muſt be very ſharp, ſtrong, and well ſteel'd, that the weight of the roller, as it goes round, may not fail to preſs them all into the earth, as deep as they can go, and yet not damage them, either by blunting, bending, or breaking.

One horſe will very well draw this roller, with which you muſt go over the ground you intend to burn, the contrary or croſs way to that which you deſign to take with your plow, before deſcribed; which will by this means turn up the turf in pieces of two foot long, and one broad, the exact ſize they ought to be to form the little hills above named.——I have nothing to add upon this head, but, that thoſe who practiſe it had need be careful how they *over-burn* the turf, which would, in that caſe, be robb'd of much of its fertility. A gentle fire, not flaming out, but mouldering inward, is the ſureſt means of hitting the perfection of this work.

In like manner Mr. Worlidge cautions us againſt over-burning the turf; and the reaſon is, that, in the burning of any vegetable, a gentle, eaſy, and ſmothering fire, does not waſte the volatile nitrous ſpirit ſo much as a quick fire would do, and cauſes more of it to fix and remain behind.

Moſſy grounds are peculiarly benefited by being burnt. Where much long moſs grows thick, ſays Mr. Liſle, tho' the ground be never ſo ſandy in its nature, yet the ground underneath muſt be of a moſt cold and ſour nature, by being kept from the ſun, and the wet more ſogging in it than if it had been ſolid earth upon it; for nothing retains moiſture longer than ſuch a ſpungy body, nor breaks the rays of the ſun more from penetrating. Therefore ſuch ground ought to be burn-beak'd; or the moſs harrow'd up before ſeeding, and burnt in heaps; but rather burn-beak'd, to deſtroy the ſeeds of weeds.

weeds.——If any do appear afterwards, the firſt year, it can be only ſome few that lay deeper in the earth than the fire went.

We ſhall conclude this article with M. Duhamel's account of burn-beaking in France.

With reſpect to lands which are plowed up but once in eight or ten years, it is the cuſtom to burn them, in order that the fire may divide the particles of the earth, and that it may be fertiliſed by the aſhes of the roots and leaves. This operation is performed thus.

They raiſe the ſurface with a hoe, or crooked pick-ax, the iron of which is very broad and thin, cutting each turf as regular as poſſible, about eight or ten inches ſquare, and two or three inches thick.

As ſoon as theſe turfs are cut, they employ women to pile them ſhelving one againſt another, with the graſs ſide inward.

When the weather is fine, the air will dry them in a couple of days, ſufficiently for making the furnaces and burning them: but if it ſhould prove rainy, you muſt be careful to turn the turfs, for they muſt be thoroughly dried before you make the furnaces we are going to ſpeak of.

In forming the furnaces, they begin with raiſing a ſort of cylindric tower, of betwixt three and four feet diameter. As the walls of this little tower are made of the turfs, their ſize determines the thickneſs: but in building them they always lay the graſs downwards; and they make a door, about a foot wide, on the windward ſide.

On the top of this door they lay a large piece of wood, which ſerves as a lintel. Then they fill all the inſide with ſmall dry wood mixt with ſtraw; and finiſh the furnace by making a vault of the ſame turfs, like the top of an oven.

Before the vault is entirely finiſhed, they light the wood that fills the furnace, and then immediately cloſe up the door with *turfs*, and ſtop the opening that was left at the top of the vault; taking care to lay turfs on all the places where the ſmoke comes out too plentifully, juſt as the charcoal-makers do: for without that precaution, the wood will conſume too faſt, and the earth not be ſufficiently burnt.

If you were to cover the furnaces with earth, all the crevices being too cloſely ſtopp'd, the fire would be extinguiſh'd: but by uſing only turfs,

turfs, and always laying the graſs downwards, there is air enough to keep the fire burning.

When all the furnaces are made, the field ſeems covered with little hay-cocks ranged in quincunx's: but you muſt watch the furnaces till the earth is red hot, to ſtop with turfs any cracks that may happen, to repair ſuch as may be in danger of falling, and to light again ſuch as may be extinguiſhed. When the earth ſeems all on fire, they want no farther care: even rain itſelf, tho' before much to be feared, will not hinder their being ſufficiently burnt: ſo you have nothing more to do but to let them go out of themſelves.

At the end of twenty-four or twenty-eight hours, when the fire is extinct, all the heaps are reduced to aſhes, except ſome of the tops which will remain not ſufficiently burnt, they not being enough expoſed to the action of the fire: and 'tis for this reaſon that we adviſe not to make the furnaces too big, becauſe, the walls being proportionably thick, the outſide of the turfs will not be done enough, when the inſide is over-done: for if you burn them like bricks, they will not be fit for vegetation. Beſides, in making large furnaces you will have too far to carry the turfs. You might even make them leſs, but that it would conſume too much wood. You will therefore find it neceſſary to conform pretty nearly to the proportions we have preſcribed.

When the furnaces are cooled, they wait till it rains, and then ſpread the burnt earth as even as poſſible, leaving none on the ſpots where the furnaces ſtood, which nevertheleſs will produce finer grain than the reſt of the field; for which reaſon they leave only ſuch turfs as are not burnt enough on thoſe ſpots.

They immediately plow it very lightly, to begin to mix the burnt earth with the ſurface; but they go deeper in the following plowings.

If you can give the firſt plowing in June, and rain follows, it is poſſible to reap ſome advantage from the land immediately, by ſowing turneps, radiſhes, or millet; which will not prevent your ſowing wheat or rye the autumn following.

It is however beſt to loſe the advantage of ſuch a firſt crop, that you may have the whole time to prepare the land well for the reception of wheat.

Some chuſe to ſow rye rather than wheat, becauſe the firſt production being very vigorous, wheat is more apt to be laid than rye.

Some do not ſpread the burnt earth till juſt before the laſt plowing for wheat. They content themſelves with plowing well between the furnaces, which they take care to ſet exactly in a line, in order to leave a free paſſage for the plough. But this is a bad method: for, ſince wheat is always apt to be laid the firſt year after burning, it is better to ſpread the burnt earth early, before it loſes part of its heat, and for the convenience of well preparing the land: for it is very material, that the burnt earth ſhould be perfectly well mixt with the ſoil.

It muſt be owned that this method of burning is very expenſive, becauſe the labour muſt be performed by men, and that it conſumes a great deal of wood: but it is very advantageous; for after this ſingle operation, the land is better prepared than it would be by many plowings.

CHAP. IX.
Of PLOWING.

MR. Duhamel, in the firſt part of his eighth chapter, enters into a detail of the French method of plowing, which, not being ſo good as what is generally practiſed in this kingdom, we ſhall paſs over, and give inſtead of it what appears to us the ſimpleſt and moſt rational practice here.

We join with the author of the *New Syſtem of Agriculture*, in thinking that there is no occaſion for more ploughs than two; one for hard or heavy ſoils, and the other for light or mellow. There are, ſays he, in England, above an hundred different ſorts of ploughs, and all bad. It is ſurprizing to ſee the toil and charge ſome people put themſelves to, for want of a compleat knowledge in the make and management of this uſeful inſtrument.———I have ſeen, continues he, eight oxen tack'd to a plough, which the weakeſt beaſt in the team would have eaſily drawn in a much heavier ſoil.——He then diſtinguiſhes the only two ploughs he thinks worth uſing, by the names of the *ſtrong* and the *light*.

The *ſtrong* plough is to be uſed on all hard clays, ſtiff binding ſoils, and ſtony grounds, or any lands of that nature.———It is drawn by two oxen, nor are any more at any time neceſſary.——The following is his deſcription of it.

Let the length of your ſhare be a foot and a half; the point indifferently ſharp, but very ſtrong: let the ſhelving ſide be work'd thick,

thick, and without a *fin*, but ſteel'd all along its edge, from the point to the hinder part, where its perpendicular height muſt not exceed ſix inches.——The breadth muſt be juſt ſufficient to carry a furrow ſeven or eight inches broad. In this plough, the place of the breaſt-board muſt be ſupplied by an iron plate, which, joining to the ſhare, and being part of it, is, in a bellying manner, carried back, and gradually brought to *whelm*, as if it would fall upon the furrow. This plate, being made as thin as its uſe will permit, is ſupported by a pin from the plough-head, which is, in all reſpects, the ſame with that of the plough I before recommended for paring up the turf of lands to be burnt.——This breaſt-iron, with all the neatneſs and facility imaginable, takes the earth, as it riſes on the ſhare, and, without labouring under the load of a long furrow, turns it over as it runs along, and neither toils the oxen nor the driver.

One man is enough in all reaſon to manage this plough. He guides his oxen by a goad, as uſual; and holds the handles with a great deal leſs fatigue than in other ploughs, for they are to be ſet at a large ſlope, and their ends ſtanding wide from each other, they have the greater power over the going of the plough. If the ſhare is apt to *bite*, or run too deep into the ground, his leaning a little harder than ordinary, on the handles, will raiſe the point to what pitch he pleaſes; as, on the contrary, when he lays no ſtreſs upon them, the team will of courſe draw the point downward.

The *light* plough is properly to be uſed on ſandy mellow grounds, and all ſuch as are directly oppoſite to thoſe for which the *ſtrong* plough is recommended. It is drawn by two horſes, with no manner of difficulty; or with one, if you pleaſe, for many have tried it.

The ſhare of this plough, is, in a manner, the ſhare of the *turfing*-plough, divided into two equal parts. The ſhare of the *light* plough ſhelves only one way, as not being double, and has a *breaſt-iron* exactly like that of the *ſtrong* plough. In all other reſpects, it is the very ſame with the *turfing*-plough, even in dimenſions, and therefore needs no farther deſcription.

One man will hold and drive this plough, with more eaſe than the ſtrong one, becauſe the loads are more manageable. The reins, whereby he turns and checks the horſes, paſs through two long ſlits, in each handle one, and being juſt of length enough to hang down five inches, or more, are prevented from being drawn back through the ſlits, by two pieces of wood, to which their extreme ends are faſtened.

Our opinion with reſpect to ploughs is, that the beſt is that which is the moſt ſimple in its make and tackle; that requires the leaſt ſtrength to draw it, in proportion to the ſtiffneſs of the ſoil; and by the ſhape of the earth board, is beſt adapted to turn the turf, or furrow, upſide down. The wheel'd ploughs are too complex: the weight of the fore-carriage, and the friction of the wheels, greatly increaſe their draught. The completeſt plough is the Rotheran or patent plough. One man, with two horſes, will do as much in a day with that plough, and in ſtiff land, as a plough with wheels, two men, and ſix horſes can do in a moderately light ſoil.——— The principle of the Kentiſh plough with the ſhifting mould-board, is very good, where the land is dry and will admit of it.

The anonymous author of the *New Syſtem of Agriculture* makes a very good and uſeful obſervation, which it may not be improper to inſert here. 'Tis this: " When the land you are to plow, is the " ſide of a very ſteep hill, as it often is, 'tis downright madneſs to " proceed, as moſt countrrymen do, by plowing directly up and " down the *ſteep*. In this caſe, 'tis pity the driver is not in the place " of his team: he would then, perhaps, diſcover, that 'twould be " the wiſeſt way to plow croſs the hill, by which means, the cattle " would not only draw with the ſame caſe as if they work'd on plain " ground, but the furrows, lying athwart, would prevent the rains " from waſhing down the fatneſs of the ſoil, with every flood; a " misfortune, to which, at preſent, all theſe lands are yearly liable, " and often ruin'd, and impoveriſhed by it."

Mr. Tull, for the ſame reaſon, adviſes plowing hills nearly horizontally: and as a farther advantage, he obſerves, that their parting furrows, lying open, may each ſerve as a drain to the ridge next below it.

We ſhall now give our former author's directions, as the beſt we know of in ſo ſmall a compaſs, for the farther management of lands according to the old huſbandry, which we have hitherto been chiefly ſpeaking of.

Common and indifferent lands, ſays he, I diſtinguiſh into *heavy* and *light*, and comprehend, in this diſtinction, every particular difference of ſoil, which is known in this kingdom. All deep, hard clays, of what colour ſoever; all ſtiff, chalky, binding earths, and ſuch, as after being expoſed to the ſun, or froſt, grow hard and ſtony; with ſuch as, in the violent heat of ſummer, chop and cleave upon their

their ſurface; all theſe I call *heavy* lands, not only becauſe of the cloſeneſs and firmneſs of their nature, but as they all hang *heavily* on the labour of the plowman and his team.

On the other hand, all ſandy, mouldering, gravelly, warm, mellow ſoils, all looſe and open earths, of what nature ſoever; all ſuch as are not ſticky, but will preſently dry after rain; and, inſtead of lying in huge clumps after plowing, are eaſily apt to diſſolve, and crumble into mould, not being ſubject to bind by the heats in ſummer and froſts in winter; all grounds of this kind, I diſtinguiſh by the name of *light* lands.

I ſhall take each of them from their firſt breaking up in the turf.

Let us ſuppoſe then, that, at Lady-day you begin your huſbandry, and that the quantity of land you are about to break up, is an hundred acres. The firſt thing neceſſary is, carefully and judiciouſly to obſerve both the *ſurface* of your ground, and the *depth* of it. If you find it a good deep mould, and covered by a thick, ſtrong, fibrous turf, ſuch as by long lying, is become firmly rooted; in this caſe it will be much the wiſeſt way to *burn* and ſpread the aſhes, by the rules before given, not, by any means, omitting to manure, between the firſt *reaping* and the ſecond *ſowing*; after which you may proceed in all points, as if the turf had been plow'd in, inſtead of being burnt.

But if, on the contrary, you find your upper mould ſhallow, or thin turf'd, it will by no means be proper to burn it: you muſt, therefore, take notice, whether your ſoil be of the *light* kind or the *heavy*. If, upon examining it by the marks above-mention'd, you find it of a *heavy* nature, you muſt prepare your *ſtrong* plough and ox team, and take care that, in the firſt breaking up, as they call it, your plowman turns the turf ſide neatly downwards, and lays his furrows ſo ſmooth and cloſe together, that, at a little diſtance, a man can ſcarce ſee where the plough went. An acre and a half may eaſily be plow'd in one day, by the uſe of this plough; ſo that, beginning by the firſt of April, and allowing for Sundays and accidental hinderances, the hundred acres will be all broke up by the middle of June at fartheſt.

Between this firſt plowing and the ſecond, is the only proper time for laying on your *manure* of what kind ſoever. The ſeveral ſorts proper for lands of this nature, are *ſea-ſand*, *common-ſand*, *ſea-owſe* of the lighteſt kind, not ſuch as is black and greaſy; *ſheeps-dung*, mix'd with *ſand* under a cover'd fold, as before deſcribed; or, for want of any of theſe, the *compoſt* in your ſtercorary.

Which ever of theſe you lie moſt convenient for, you may make uſe of, in the following proportions: of *ſea-ſand* you muſt lay upon every acre five and twenty loads; of common ſand never leſs than a hundred, which quantity you may double, if it lies commodiouſly: twenty load of *ſea-owſe* is ſufficient; and fifteen of *ſheep's dung* ſo mingled: and if you are obliged to rely upon the aſſiſtance of your *ſtercorary*, you muſt lay about twenty load upon an acre.

According to the manure you are obliged to uſe, your charge will be more or leſs conſiderable in the number of carts and teams neceſſary: for this rule you muſt be ſure to obſerve punctually, that the *manure* be all laid on by the laſt day of July; in which time, the plowman, a labourer being employ'd to ſpread the manure, as it is daily brought on, does, with the ſame plough he uſed before, give the ſecond ſtirring to the ground, in order to turn in the richneſs of thoſe helps you have beſtowed upon it. By this means the ſun, high and powerful in this ſeaſon, will be prevented from exhaling the *virtue* of your manure, as it always does in the common way of letting it lie in little heaps in the field for a great while together.

You may obſerve, that, I allow a ſhorter time for *this* plowing, than for the *firſt*; and the reaſon is, becauſe the ground having been broken up before, and the turf now rotten, it is become more mellow, and the draught ſo much eaſier, that a team may diſpatch almoſt a double quantity in a day.

It is now the time to harrow over your ground, with a heavy wide-tooth'd harrow, and a great weight laid upon it; by which means more mould will be rais'd, the clods broken into ſmaller pieces, and the manure mingled with the ſoil in every part. It is not enough to harrow once and away;——you muſt go over the ſame ground again and again, till you have made it as ſmooth and crumbly as is requiſite: and this work will very well employ your team, from the end of July, to the middle of Auguſt: about which time ſhould be begun the third and laſt plowing.

I come now to your lands of a *light* temper, and, for method's ſake, will begin at Lady-day upon this land alſo. Here the *light* plough is to be uſed; and as to the turning down the turf, and lay-

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ing ſmooth the furrows, the ſame care is to be obſerved on one land, which is recommended on the other. Of this work, two horſes, with the plough afore-mentioned, will conſtantly break up two acres a day; and beginning with April, and allowing, as before, for Sundays, &c. the hundred acres will be very well plowed, for the firſt time, by the latter end of May.

Betwixt the *firſt* arature and the *ſecond*, theſe lands are alſo to receive the annual recruits which you think fit to give them; and that may be either *chalk*, *marle*, *clay*, *ſheeps-dung*, prepar'd with *earth*, not *ſand*; *ſea-owſe* of the cloſeſt, black, fat kind; all ſorts of *mud*, or, for want of either of theſe, your *ſtercorary* may ſupply you.

Five and twenty load of the laſt is the quantity moſt proper; thirty of chalk; of marle, at leaſt a hundred; and of clay, a little more. Twenty load of prepar'd ſheeps-dung, and as much of ſea-owſe; and if you uſe mud, leſs than forty or fifty load will be too little. Uſe either of theſe manures as your beſt conveniency invites you, and, as was directed before, take care that your plowman turns it in as faſt as it is brought on, and ſpread upon the ſurface.

But here comes a neceſſary caution, that your men begin to bring on the manure on that end of your hundred acres which your plowman firſt began to break up, that the turf may be rotted before it is turned up the ſecond time.——Be regardful of this rule, or you will find the neglect of it produce a great deal of confuſion.

When the manure is all turned in, bring on your heavy harrows, and go over the land ſo often, as till the whole maſs is exquiſitely mingled, and the mould becomes fine and duſty. You muſt be doubly careful in this operation upon your *light* lands, which ought by the harrow to be laid as ſmooth and level as a table.

About the beginning of Auguſt will come on your *ſeed plowing*, properly ſo called upon theſe *light* lands, becauſe you muſt here *plow* and *ſow* together.

Authors give directions for plowing lands into many different forms, moſtly ariſing from the different natures of ſoils, but too often from the particular long eſtabliſhed cuſtom of countries, without ſufficiently entering into the reaſon of it.

Light ſoils are always plowed into broad lands, unleſs a very flat ſituation renders it neceſſary to plow into narrow ſtitches for wheat.

Strong ſoils are, without exception, adviſed to be plowed into narrow ridges.

It would be moſt adviſeable, always to lay the ground level, and without

without ridges, where practicable. In summer fallowing, it might be used to great advantage even in clay lands.

In plowing wet land, for winter fallowing, I am not certain whether the best way would not be, instead of single bouts or narrow ridges, to make the ridges very broad, and lay them up very high: for if the ground is level, the water will lie in the parting thoroughs, and by soaking into the sides of the ridges, make it so poachy, as to render it very unfit to be worked, till late in the spring, unless the season is very dry; or, if there is much descent, great part of the best soil will be carried off.

We now return to Mr. Duhamel, who proceeds thus:

Mr. Tull says, the produce of the earth is increased by raising the ridges high, because the surface is thereby enlarged. As he insists greatly on this point, we cannot help mentioning his reasons, and those which induce us to differ from him.

He was sensible it would be objected to him, that the produce of a sloping surface is not greater than that of a plane equal in extent to the base of the slope: for the plants growing perpendicular to the horizontal base, there is no point of the slope, which does not answer vertically to a point of the horizontal base.

But he maintains, that the produce of the earth is in proportion to the inclined or sloping surface; because the roots have a greater extent of earth to draw their nourishment from; and because the ears of corn rising one above another, in the manner of an amphitheatre, are better enabled to receive the influences of the air, which certainly is of service to vegetables.

I shall not insist on the perpendicular growth of the stalks of plants, though I believe it real. But to shew Mr. Tull, how inconsiderable the advantage of what he recommends would be, I will suppose the furrows of a piece of ground plowed in broad-lands to be six inches deep, and the ridges six feet wide. The slope from the bottom of the furrow to the middle of each ridge will be one foot in six, which is considerable: but still the surface of the ridges will be to that of their horizontal base, only as 76 to 75. This is a small advantage, compared to a sixth of the ground, which is taken up by the furrows, and in which no corn is planted.

But, as in all this we consider lands only relatively to the common method of culture, it must be owned, that Mr. Tull might full as well not have entered into this question, which is quite foreign to the purpose in hand, since, even according to his own principles, it

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is beſt not to ſow above one third of the ſurface of any land.

The deſign of tillage is, to deſtroy weeds, and to reduce the earth to very ſmall particles. The ſpade is very fit for theſe purpoſes, becauſe, by turning the ground upſide down, the weeds are covered with a quantity of earth, under which they rot. Beſides, it ſtirs the mould eight or ten inches deep. But this operation is tedious, laborious, and expenſive; ſo that it can be uſed only in gardens.

The plough is more expeditious; but, in general, it does not ſtir the earth ſo deep, and often turns it over in one great clod, without breaking it into pieces; for the coulter cuts the turf, the ſhare which follows opens and raiſes it up, and the mould-board turns it over all in a lump,——Mr. Tull has endeavoured to improve this tillage; and to that end he has invented a plough with four coulters, inſtead of one. Theſe coulters are placed in ſuch a manner as to cut the earth which is to be opened by the ſhare, into ſlips of two inches breadth; ſo that when the plough opens a furrow of ſeven or eight inches wide, the mould-board turns over a well divided earth, which does not fall in large clods, as after the common plough. The conſequence of this is, that, on a ſecond plowing, the plough turns up an earth already conſiderably broken, inſtead of meeting with clods, and even turf, which, having taken freſh root ſince the former plowing, is as difficult to break, as if the earth had never been plowed.

Mr. Tull ſays farther, that his new plough can ſtir the earth ten, twelve, or fourteen inches deep; and as this plough makes deep furrows and very high ridges, a larger ſurface of the earth is expoſed to the influences of the air.

When a field is intended to be broke up, which has not been plowed of a long time, the earth ſhould be very moiſt, eſpecially if it be a ſtiff land; for otherwiſe it would be ſo hard, that the coulter would not be able to cut it, nor the ſhare to turn it up. But when lands are in tilth, care muſt be taken not to plow them when over wet; becauſe the trampling of the horſes and the ſhare itſelf will poach and as it were knead ſtrong lands, almoſt equal to what potters do when they prepare their clay for uſe; and thus the land is damaged, inſtead of being improved.

The four-coulter'd plough kneads the earth leſs than the common plough; becauſe the ſhare of the latter raiſes it up by preſſure, whereas the coulters of the former having firſt cut it into ſmall pieces, the ſhare turns it over without hardly preſſing it all.

Mr. Tull recommends putting all the horſes length-ways, when a ſoft ground is plowed; that, by their treading all in the furrow, the earth may be leſs poached.

If the land is in good tilth, it may be plowed in dry weather: but the beſt time is when it has been a little moiſten'd by rain, eſpecially for the new plough, which would not eaſily go deep, if the earth was very dry.

'Tis true that as the four-coulter'd plough enters deep, and turns up a great deal of earth, a greater ſtrength is required to draw it; ſo that it will be neceſſary to uſe three horſes inſtead of two, and four inſtead of three. But the excellence of this tillage will make ample amends for that additional expence.

The four-coulter'd plough is uſed only for the firſt plowings, to break up freſh grounds, or give a good tilth to thoſe that have not been plowed before, or that have been ill plowed for a long time. It is likewiſe very fit for winter plowings; and I think Mr. Tull uſes it ſometimes to make deep furrows in the middle of the alleys between the rows of corn.

But he does not pretend that all plowings ſhould be made with this plough. He approves of the common plough, as far as I underſtand him, for the ſummer plowings, tho' he generally employs for that uſe a lighter plough with one coulter and without any wheels, which he calls the *horſe-hoe*; becauſe he performs with this, what bears ſome reſemblance to the common hoeing. 'Tis chiefly with this that he plows the alleys, or cultivates plants while they are growing.

Mr. Tull has not only contrived inſtruments to bring the earth to a proper tilth, and others to preſerve it ſo; but, convinced that in the common method of ſowing, the ſeed is neither diſtributed equally, nor buried at the proper depth each kind of ſeed requires, he has likewiſe invented a *ſower*, or what he calls a *drill-plough*, which makes the furrows, drops each grain at its proper depth and diſtance, and, filling up the furrow again, covers the ſeed.——As this inſtrument does not ſeem to us ſufficiently complete, we ſhall give deſcriptions of other *ſowers*, which we think preferable to his, in the laſt part of this work.

CHAP.

CHAP. X.

Of the advantage of cultivating annual Plants while they grow, as the Vine and other perennial Plants are cultivated.

THE earth is generally prepared to fit it for receiving the feeds of annual plants; and, fome few leguminous plants excepted, all others are left to fhift for themfelves, till they have yielded that part for which they are cultivated.

But we propofe tilling the earth during the growth of annual plants, as is done with the vine and other perennials in different feafons of the year.

This propofition is a natural confequence of what we have faid before: for as we have fhewn that tillage is of very great fervice to plants, it is proper to make ufe of it when they are in the greateft need of food. Tho' land be never fo well tilled in autumn, it hardens or faddens in the winter, its particles approach one another, weeds fpring up, which rob the ufeful plants of their nourifhment; and at the end of the winter, the ground is in nearly the fame condition as if it had not been plowed at all. Yet it is at this feafon that plants ought to fhoot with the greateft vigour. They confequently now ftand more in need of the plow, to deftroy weeds, to lay frefh earth to their roots in the room of that which they have exhaufted; to break the particles of the earth anew, to enable the roots to extend themfelves, and gather that ample provifion of food of which they at this time ftand in the greateft need.

In the common hufbandry, the whole attention is to provide a great ftore of nourifhment for wheat, at a time when it fcarce confumes any, as it then produces only a few leaves. But when the winter rains, and the firft drying heat of the fpring, have rendered the earth almoft as hard as if it had never been plowed, the wheat is abandoned to itfelf, at a time when it might, and ought to be, affifted by proper culture.

Our farmers, in this, act as prepofteroufly, as it would be to give a child a great deal of food, and diminifh it gradually as he grows bigger.

The great advantage of having land in fine tilth before it is fowed, is univerfally allowed: but we muft not ftop at thefe firft preparations. Plants require a due culture whilft they grow, and muft not be abandoned till they come to their full maturity.

Some garden plants acquire great ſtrength by being tranſplanted; becauſe, after having been confined in the nurſery, they are put into large beds, where they find a new and looſe mould. The plants of corn may be equally benefited by the plowings which Mr. Tull propoſes, that is to ſay, by ſtirring the earth near them. If any of their roots are diſplaced or broke, the plant does not ſuffer by it, becauſe it ſhoots out ſeveral inſtead of one; and moſt of the roots not having been diſplaced or hurt, they continue to ſupply the plant with nouriſhment, till the diſplaced or broken roots have taken freſh hold of the earth; and then the plant becomes more vigorous than before: for I have found by experience, that when a root is cut, it fails not to ſhoot out ſeveral new ones, which are more proper to draw nouriſhment from the earth. The breaking of a root is therefore a means of multiplying the mouths, or rather ſuckers which collect the nouriſhment of plants.

Thoſe who are againſt theſe frequent plowings, are afraid of drying the earth too much: for they ſay that the moiſture eſcapes with greater difficulty from a hard earth, than from that which has been well ſtirred by plowing.

It may be granted, that the moiſture which is in the earth, does not evaporate ſo eaſily whilſt the earth is hard, as when it is in a looſe ſtate: but, in the firſt place, it is certain, that that moiſture will be rather hurtful than uſeful to plants.

2. Our adverſaries muſt allow, that well plowed land will more readily admit the moiſture of rain and dews, than land which is not ſo. The following experiment proves the truth of this aſſertion.

If ſeveral rows of wheat are ſown in a poor but well plowed land, the blades of the corn will turn yellow in ſpring, eſpecially in dry weather. If the ground bordering upon theſe rows be plowed deep, in ſome places near, and in others at a conſiderable diſtance from the rows, the corn will recover its verdure firſt in the places that are neareſt to the new plowed ground, and afterwards gradually in the others, according to their diſtance; which proves that the wheat recovers its verdure, in proportion as its roots reach the looſe earth. This holds equally true in all plants: for Mr. Tull affirms, that he never ſaw a plant in a languiſhing ſtate, when the ſurrounding earth has been well plowed; and that, on the contrary, he has ſeen plants ſo ſituated, grow to a prodigious ſize. He inſtances,

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among others, a ſtalk of muſtard, which grew ſo high that a man of a common ſize could not reach the top of it with his hand.

In ſhort, ſtirring the earth about plants while they are growing, is ſo uſeful, that in ſome parts of Berkſhire, and in ſome diſtricts of the Gatinois, they hand-hoe their wheat; and tho' this operation is expenſive, it is affirmed that the crops amply repay all the charge and trouble. How much more profitable would it be if this labour could be done at a leſs expence? The methods propoſed in the following chapter, will ſhew that it may.

CHAP. XI.

General deſcription of the drill and horſe-hoing Huſbandry, for the culture of annual Plants.

AS we ſhall hereafter give a particular deſcription of the chief inſtruments uſed in this new huſbandry, it may ſuffice to ſay at preſent, for the better underſtanding of what follows, that the drill, which is drawn by one or two horſes, forms furrows of what depth, and at what diſtance is deſired, drops into the furrow the exact quantity of ſeed thought proper, and immediately covers it.

With regard to Mr. Tull's plough, the large one, which has four coulters, plows and breaks the earth better than the common plough: the other, which is lighter, requires leſs ſtrength to draw it, and yet is ſufficient for ſlighter work. This he calls the *horſe-hoe.*

We ſhall now examine the three following queſtions, each of them in a ſeparate article, *viz.* 1. At what depth the ſeed ought to be ſown: 2. The quantity of ſeed proper to be ſown: and 3. The diſtance at which the rows ſhould be ſown.

ARTICLE I.

At what Depth the Seed ought to be ſown.

THE ſeeds of all plants ſhould not be ſown at the ſame depth. To ſatisfy myſelf of this, I dug a trench twelve feet long, ſloping it gradually from the ſurface at one end, to the depth of two feet at the other. I ſowed different ſeeds in this trench; and having put the earth in its place, I obſerved, 1. That hardly any ſeeds riſe when buried deeper than nine inches: 2. That ſome ſeeds riſe extremely well at the depth of ſix inches: 3. That other ſeeds do not riſe at all when they are above one or two inches deep. Experience ſhews that the ſame ſeeds may be buried deeper in a light, than a heavier ſoil; and that ſeeds which lie too deep in the earth to ſpring up in a dry year, may riſe in a warm moiſt year. Experience likewiſe teaches, that ſeeds which are buried too deep in the earth, will remain there ten or twenty years ſound and unaltered; ſo that if by moving that earth they chance to be brought to the ſurface, they grow extremely well, and produce their proper plant.

It appears from hence, that each kind of grain ſhould be ſown at its proper depth, which is beſt known by experience. Mr. Tull therefore propoſes having twelve gauges or ſticks, to be uſed as follows. Bore a hole in one at the diſtance of half an inch from the end, in the ſecond at an inch, and ſo on increaſing half an inch to each of the twelve. Drive a peg into each of theſe holes: then, in that ſort of ground where you intend to plant, make a row of twenty holes with the half-inch gauge; put therein twenty good ſeeds; cover them up, and ſtick the gauge at the end of that row; then do the like with all the other eleven gauges: this will determine the depth at which the moſt ſeeds will come up, and the drill muſt be ſet accordingly.

ARTICLE II.

Of the quantity of Seed proper to be ſown.

IT frequently happens in ſowing by hand, that one handſul is larger than another; that the grains being ſmaller, the ſower takes a greater number of them into his hand. If the field is rough and full of clods, the greateſt part of the ſeed is collected in the hollows, whilſt but little remains on the higher parts. By this means the ſeed is diſtributed very unequally.

Beſides, too much ſeed is employed in the common way of ſowing: becauſe, as it is buried at different depths, what is buried too deep, does not riſe at all; whilſt that which remains uncovered, is eat by birds.

Theſe inconveniences are prevented by the drill. For, 1. It makes the furrows at any diſtance you pleaſe, and at whatever depth experience has ſhewn to be moſt proper for the ſeed that is ſown. 2. As the drill fills all the furrows with earth, none of the grain remains uncovered. 3. The drill drops into each furrow the exact quantity of ſeed that is found to be moſt proper.

Every ſeed is therefore placed ſo properly in the earth, by means of of the drill, that we may depend they will all do well, unlefs they are hurt by infects.

But as the drill fows only the quantity of feed that is abfolutely neceffary, one ought to be certain of the growth of every grain; becaufe it often happens, that part of the feed is imperfect, and does not fprout at all. As the eye cannot diftinguifh its quality, we fhould affure ourfelves of it by experiment, by fowing fifty or an hundred grains taken by chance, but exactly numbred; and, when they fpring up, the number of plants will fhew whether a tenth, a fixth, or a third part be deficient, and the quantity of that which is fown fhould be increafed accordingly.

It is farther propofed to fow the feeds in rows. Thefe rows fhould be fingle, double, triple, or quadruple, according to the different kind of plant intended to be cultivated, as we fhall fhew hereafter. A fpace of feven or eight inches, which Mr. Tull calls *partition*, is left between thefe rows. The fpace occupied by the rows, we fhall, with Gardeners, call the *bed*; and the large intervals between the beds, we fhall call *alleys*.

We have fhewn that the drill ought to diftribute more or lefs feed in the rows, according to the nature of each plant. To know the fpace that fhould be left between the feeds in the rows, it is neceffary to obferve how much ground a ftrong and vigorous plant of each kind takes up, that the drill may be fet fo as to drop each grain, at the diftance that a very thriving plant requires: for we may be affured that all the plants will arrive at their greateft perfection, when cultivated according to the new hufbandry.

ARTICLE III.

Of the diftance at which the rows fhould be fown.

WHAT may at firft fight feem to be a confiderable objection againft the new hufbandry, is, the width of the alleys or fpaces between the beds. Many will be furprifed that fo much land fhould lie, as they think, loft. But a trial of the new method will foon remove this prejudice.

At harveft, it will be found that moft of the grains of wheat have produced twenty or thirty ftalks a-piece; whereas, in the common hufbandry, they feldom exceed two or three. If it were poffible to diftribute each of thofe twenty or thirty ftalks in the alleys, the earth would appear as well covered as when the whole is fown in the ufual broad-

broad-caſt way. But as the ears are likewiſe larger, and filled with better grain, it follows, that, the crop is, in fact, more plentiful.

In the common way of ſowing, the earth appears at firſt ſight well covered with plants. But as all theſe plants cannot find ſufficient nouriſhment, and it is impoſſible to aſſiſt them by culture, many of them periſh before they ripen, the greateſt part of them remain poor and ſtinted, and the ſeed is almoſt entirely loſt: whereas by the new method, all the plants find ſufficient nouriſhment, and being aſſiſted from time to time, by proper culture, become ſtrong and vigorous; inſomuch that I have ſeen land cultivated in the common way, not yield the fifth part of the produce of lands ſown and cultivated according to the new method.

A quick-hedge, planted between two plowed fields, of only a foot thickneſs at bottom, and eighteen feet in length, will yield at the end of fourteen years, as much wood as a copſe of the ſame wood, which ſhould be eighteen feet ſquare. Yet if both be cut down every year, the copſe will yield perhaps ten times the quantity of wood that hedge would do. Why does a ſpace of eighteen feet ſquare planted in copſe-wood diminiſh in the quantity of wood it yields, more than a hedge does, after each of them has ſtood ſeveral years? It is evident that the difference conſiſts in the copſe loſing every year a great number of branches for want of air and nouriſhment, and by its not being aſſiſted by culture. This compariſon ſhews the great benefit that may be expected from the new huſbandry.

If it be ſaid that plowing will break the roots of the plants; I anſwer, that ſome of theſe roots will only be removed to another place and into a freſh earth, and that thoſe which are broken will be ſo only at their extremities, which, as we ſaid before, will make them ſhoot out a greater number of new roots, fitter than the old ones to draw the nouriſhment of plants from the earth. There is no doubt but that one of the chief advantages ariſing from hoeing, digging, or plowing, is this cutting of the roots.

The plough has perhaps this advantage over the ſpade, that the latter cuts all the roots it meets with; whereas the plough often does no more than remove them from one place to another, from an exhauſted, to a freſh earth.

Beſides, when land is ſowed according to our method, it is leſs exhauſted than in the common way; or rather, it will be in a condition to ſupply ſeveral crops of wheat, which will become better and

better

better every year, because the corn is sown in beds made in the middle of the former alleys, where the earth has been thoroughly and deeply plowed. This will be more fully proved hereafter. In the mean time we shall mention an experiment of Mr. Tull's, which confirms what we have been saying.

Half of a poor field, but well dunged, was planted in the common way with potatoes. The other half of the same field was planted in beds, according to the new husbandry, and plowed four times while the potatoes grew. The potatoes seemed, at first, to thrive best in the part that was planted in the common way; but afterwards those planted in beds throve exceedingly, and yielded a most plentiful crop, whilst the others were scarce worth the digging.

As it is proposed to plow the ground whilst the plants are growing, the alleys should be wider for large plants than for small ones; for such as remain long on the earth, as wheat, than for those which are but a short time on it, as barley. The breadth of the alleys should likewise be varied, according as the earth is stiffer or lighter. But, in general, when land is sowed with wheat, the alleys ought to be four feet, or four feet and a half wide.

CHAP. XII.

Of Change of Species.

BOTH the English and French have most of their flax seed from Flanders; and it is observed that when they sow that seed, the crop of flax is much finer than when they sow their own.

Cauliflower seed was for a long time brought from Malta, melon-seeds from Italy, the seed of luserne from Languedoc; and good farmers are very careful in changing part of their seed corn every year.

There seem to be many reasons why this practice should still be continued.

Some plants agree better with one climate than another. Such will thrive best in the climate that may be called most natural to them. Sickly plants never bring their seeds to perfection; and to this it is undoubtedly owing, that the seeds which are gathered in a climate that does not agree with the plant, produce that plant less perfect than those which are gathered in a climate that is natural to it.

With all the art the French make use of to raise melons, they fall short

ſhort of thoſe of Italy, where this plant grows almoſt without culture*. If they did not take care to ſave the ſeed of their beſt melons, they would ſoon have no goodones left. But as their beſt melons are inferior to thoſe of Italy, ſo their beſt ſeed may be compared to the middling ſeed of that country. This ſhews ſufficiently how right it is to bring the ſeeds of plants from thoſe countries where they thrive beſt.

It is evident that in the ſame province, the quality of the ſoil may have the ſame effect on corn, as the climate has: for when plants grow ſtinted and ſickly in a poor ſoil, it is natural to believe that the ſeeds muſt partake of the weakly diſpoſition of the plant which produced them; and that their productions cannot be ſo fine as thoſe which grow from the ſeeds of ſtrong and healthy plants. For this reaſon Mr. Tull adviſes to take the ſeed corn from a richer ſoil than that in which it is to be ſowed, and rather from well cultivated land, than from land that is not ſo. I cannot ſay I think him wrong; tho' the contrary opinion is almoſt generally received: becauſe, the firſt productions of a fine good ſeed, being ſtrong and well conditioned, more may reaſonably be expected from them, than from a poor weakly plant.

Another advantage in changing the ſeed, is, that there are ſome weeds which delight in particular ſpots, and do not thrive ſo well elſewhere. If a farmer ſows wheat of his own growth, he increaſes the weeds which thrive particularly in his land; whereas, by changing his wheat, the weeds which he brings into his ground, not being in the ſoil that agrees beſt with them, will do leſs damage to his corn.

However, Mr. Tull thinks, that change of ſeed may be diſpenſed with, by the means of the new huſbandry; becauſe, by his method of culture, almoſt all weeds are deſtroyed, and the plants being very ſtrong, their ſeed ought to be preferred to any other for ſowing; eſpecially when they are not foreign plants, which borrow their quality from the climate they are raiſed in.

What is here advanced may admit of ſome difficulty, for it is known (and Mr. Tull allows it) that ſmall wheat produces as ſtrong plants as the largeſt. If ſo, wheat that has grown in bad land, would be as good for ſowing as the very fineſt, provided it were well conditioned in other reſpects.

* This, ſays Mr. Duhamel, is diſputed: for though in hot countries all melons are eatable; yet ſome pretend that there are few ſo good in Italy, as at Paris and in Touraine.

Dr.

Dr. Home, p. 136. accounts very rationally for the advantages arifing from changes of crops, from the different effects of their roots. " The fibrous rooted divide directly into fmall fibres which run in all " directions, but moftly horizontally. The carrot-rooted fend one " great ftem directly down, which has lateral fibres. The former, " in which clafs are reckoned all the white grains, rye-grafs, *&c.* " confolidate the ground; while the latter, in which clafs are reck-" oned the leguminous plants, turneps, carrots, clover, attenuate " and loofen the earth exceedingly. The fibrous roots muft bind " the foil together like fo many threads, while the carrot-roots divide " like a wedge, and by their mere mechanical force, cut the earth. " The leguminous plants, by covering the foil, keep it moift, hinder " the fun from confolidating it, and deftroy weeds, which help fo " much to bind it. Perhaps the carrot-rooted may operate likewife, " by feparating more moifture from the root to keep the earth " loofe."

We fhall conclude this chapter with obferving, that when we admit that plants degenerate in climates or foils which do not agree with them, we are far from thinking they change their fpecies thereby; that wheat becomes barley, oats, tares, *&c.* This opinion is fo exploded now, that it needs no refutation. I cannot however avoid mentioning an experiment made with great care, by a neighbour of mine in the country.

The chevalier de Laumoi, in order to fatisfy himfelf whether March wheat does really degenerate into barley, as many have afferted; and well knowing it is almoft impoffible to buy wheat in which there is not fome mixture of barley, any more than it can be had abfolutely free from rye; picked grain by grain a quantity of March wheat fufficient to fow an acre of land, and at the fame time fowed another acre with feed bought at market, without being culled. He was not furprifed, at harveft, to find barley in this laft acre; for, as he had fowed it, it was natural he fhould reap it: but in the other acre, where he was fure he had not fowed any barley, he did not find a fingle ear of it; nor could he, on a nice examination, find one grain of barley in any of the ears. If therefore a little rye is found in wheat, and a little barley in March wheat, it is becaufe thefe grains are fowed in the fame feafon, in lands equally prepared: they are gathered in at the fame time, and laid up in the fame barn. This is more than enough to occafion the mixture that is almoft always obferved.

After having mentioned the general principles on which the new husbandry is founded, we ſhall apply it to the particular culture of different plants, ſuch as wheat, turneps, ſain-foin, luſerne, *&c.* We ſhall begin with wheat; firſt in the old, and then in the new way.

CHAP. XIII.

Of the common Culture of Wheat.

SOME farmers plow down their wheat ſtubble immediately after harveſt: ſome burn the ſtubble before this plowing: others delay this plowing till after ſeed-time, and others even till ſpring: not only to allow time to collect the ſtubble, which ſerves to thatch their houſes, litter their cattle, or heat their ovens; but likewiſe becauſe they are at that time ſufficiently employed in preparing their grounds for ſowing.

Farmers ſeldom give this plowing, which they call *Winter-fallowing*, but to grounds newly broke up, or to that part of their land, which they intend to ſow with barley or peas. They delay plowing the ground for oats, till February, or the beginning of March, that they may be ſown on a freſher tilth.

Thoſe who plow their ſtubble immediately after harveſt, are obliged to give a ſecond plowing before they ſow their oats. Thus all their land is winter-fallowed; and their return at harveſt generally repays this expence and labour; for the winter fallowing is always of ſingular benefit to the ground.

Oats are ſown and harrowed during the month of March, or in the beginning of April. When they are about four inches high, the farmer takes advantage of a ſhower, which ſoftens the clods, to run a wooden roller over the ground, which, by breaking the clods, lays freſh earth to the roots of the oats, and ſmooths the ſurface of the field, ſo that the mowers are able to cut the oats cloſe to the earth which it is very fit they ſhould, becauſe oats ſeldom grow high.

Oats are reaped ſoon after wheat, and then begins the year of fallowing; during which the earth is prepared for receiving wheat the year following. We muſt not however think that the year of plowing, or plowings, which are given to the oats, is of no benefit to the wheat. I rather think that the land which has been twice plowed for oats, is the better prepared for the plowings neceſſary to bring it into a proper tilth for wheat. This has been my reaſon for

ſaying

ſaying thus much of oats, though this chapter is more immediately intended for the culture of wheat.

The firſt plowing which is given to a fallow, is to turn down the ſtubble of the oats. This may be done as ſoon as the oats are off the ground: or it may rather be delayed till the ſeed time is over. 1. Becauſe it is a buſy time. 2. Becauſe by delaying it, numbers of ſeeds ſprout up, which are ſo many weeds deſtroyed. 3. Becauſe the cattle enjoy the benefit of the paſture which the ſtubble yields. 4. Becauſe, to perform this plowing well, it is neceſſary that the earth be moiſtened by ſome ſhowers, that the plough may go as deep as the quality of the ſoil will admit.

This winter plowing ſhould be given as ſoon as the wheat is ſown, provided the farmer is ſufficiently forward in the work neceſſary in ſpring: and the ground ſhould be plowed deep, that it may be mellowed during the winter. Though the earth ſhould plow rough and grow hard, no inconvenience will ariſe from it. The winter's froſt will moulder it. Therefore we think it is of great advantage to finiſh this firſt plowing before the froſt comes on. But our farmers in general do not begin it till after their ſpring ſeed time is over.

As ſoon as the firſt plowing is finiſhed, the land that was firſt broke up is plowed a ſecond time, or, as it is commonly expreſſed, *Twy-fallowed.* This is done about Midſummer. For this ſecond plowing, the ground ſhonld neither be too dry nor too moiſt: for if it is hard and plows rough, there are now no froſts to moulder it down. There is no harm in plowing as deep as the ſoil will admit of. If the ground is level, or has been plowed into broad lands, the ſecond plowing is acroſs the former. If it has been plowed in ridges, the directions given in Chap. IX. are to be followed.

The laſt plowing is given immediately after harveſt. The different qualities of ſoils, and the circumſtances of the weather, will oblige the farmer ſometimes to vary the method we have hitherto laid down.

1. Light lands are neither plowed very deep, nor ſo often as ſtrong ſoils.

2. Strong lands cannot be plowed too often. If it is poſſible to break them up before the winter froſts, the earth will be mellowed and better prepared.

3. Some lands would be rendered leſs fertile by being plowed too deep. Others are benefited by deep plowing. I remember having ſomewhere read of a man extremely curious in the culture of his

lands, who had two ploughs following one another in the ſame furrow, in order to ſtir the ground to a greater depth. This practice might in ſome meaſure anſwer the deſign of Mr. Tull's four-coulter'd plough; and in ſome countries they plow ſo deep, that they are obliged to have ſix oxen to a plough.

4. Farmers, who have plenty of horſes, ſometimes beſtow a plowing extraordinary upon their lands, eſpecially when weeds grow much.

5. Theſe plowings are ſometimes interrupted by great droughts*, and more frequently by heavy rains. Judicious farmers partly avoid this inconvenience, by chuſing ſuch part of their land as will ſuffer leaſt by being plowed in too wet or too dry weather. For example, the plough which would poach ſtrong clayey land in rainy weather, will not have that effect on ſandy or ſtony grounds: and when the weather is dry, ſome lands will plow up in great clods, while others break into a fine mould.

6. When there is a great depth of good mould, it may be renewed every ten years by trenching†. But as this work is very expenſive, the ſame end may be anſwered by drawing two ploughs one after the other in the ſame furrow, or by making uſe of Mr. Tull's four-coultered plough.

7. The ancients are very particular in their directions not to plow when the earth is very dry, very moiſt, or frozen.

If the earth is very dry, its ſurface is ſometimes ſo hard, that the plough cannot pierce it; and if it does, it breaks it up in large clods: ſtill there is no danger of exhauſting it by plowing.

If the ground is too wet, it will be poached in plowing, and become full of weeds: and if ſtrong, it will be kneaded as it were into a paſte, ſo that another year's fallow will ſcarcely recover it.

If the frozen ſurface be turned down by plowing, it will remain longer unthaw'd by reaſon of its depth, and thereby chill the earth.

Dungs are generally diſtinguiſhed into three kinds, *viz.* 1. The dung of the larger cattle, ſuch as horſes, aſſes, oxen, cows, and hogs. 2. Sheeps dung. 3. Poultry and pigeons dung.

Grounds that have been marled, or on which ſheep have been

* One of the great advantages of the new huſbandry is, that ſtrong ſoils never have time to grow ſo hard as not to admit the plough, even in the drieſt weather; eſpecially if only one row of turneps is ſown in a bed, or two of wheat: therefore, contrary to the general opinion, ſtrong ſoils are ſtill more benefited by it, than light.

† This practice was followed in Italy in the time of Cato, and even as late as Columella. They called it *Paſtinatio*.

folded, are never dunged. The proper time of ſpreading the ſtable dung is before the twi-fallow, or at leaſt before the laſt plowing. This is likewiſe the time for ſpreading quick-lime.

In lands that lie near the ſea, the farmers manure with ſhells, ſea-weed, and the ſlimy mud which the ſea leaves in creeks, before they twi-fallow; to allow time for theſe ſubſtances to rot and mix more thoroughly with the earth. Some ſow by hand poultry and pigeon's dung on their corn, after the hard froſts are paſt. They reap great profit from this dung if the year is moiſt: but in dry years it is rather hurtful. I would therefore rather adviſe ſpreading it like ſheeps dung, before the laſt plowing.

When the wheat is very full of ſeeds, it is half threſhed without unbinding the ſheaves. By this means we obtain the beſt and ripeſt grain, with few ſeeds of weeds; becauſe the weeds, being ſhorter than the corn, are generally at the bottom of the ſheaf. Some farmers buy the gleaners corn, which being gathered in ſingle ears, is generally the ſoundeſt and beſt.

The common practice is to ſow wheat by hand, and cuſtom brings the ſower to ſpread it pretty equally. In ſmooth ground it is generally harrowed in: but the harrow not being able to bury it where there are large clods or ſtones, two rollers are made uſe of, fix'd in a frame, and full of iron ſpikes. Theſe ſpikes break the clods, ſtir the ſurface of the earth, and cover the ſeed with it. This roller is not fit for ſtrong ſoils. The ſeed is there ſown under furrow. This plowing is very ſhallow, that the grain may not be buried too deep, for then it would not grow: but if the earth is the leaſt moiſt, it will be poached, grow hard, and be greatly hurt by rolling.

When the farmer has ſown his corn, his trouble is at an end till harveſt. He then reaps it. I ſhall only obſerve, that wheat may be cut before it is full ripe; for it will harden afterwards in the ſheaf. If it is let ſtand till too ripe, it will ſhed a good deal in cutting, tying, and carrying home. It is partly to prevent this inconvenience that it is tied in the evening, and carried off the ground in the morning.

Some authors relate that in Piedmont they formerly drew a light harrow over their corn when it had ſpindled: and they add, that tho' a great many of the plants were deſtroyed thereby, the crop was however much bettered by it.

There are likewiſe farmers, who, to thin their corn when it grows too thick, let in their hogs to deſtroy part of it. Theſe practices, which

which cannot readily be approved of, may create the greater confidence in the new husbandry, which we are now going to speak of.

CHAP. XIV.

The Culture of Wheat according to the new Husbandry.

THOUGH the culture that is bestowed on plants whilst they are in the earth, is highly beneficial to all kinds of them, it is still more necessary to those which remain long in the ground. Therefore wheat, which remains nine months in the earth, requires more culture than barley, oats, or buck-wheat, which remain in it but three, four, or five months.

Wheat is sown in autumn, after the earth has been brought to a fine tilth: it springs up, and pushes forth some leaves and roots; and when the winter is mild, the roots extend themselves, and the plant shoots forth new stalks, or, as some call it, *tillers:* but by the winter rains, and the melting of the snow, the particles of the earth are so closely united together, that the soil is almost as hard and sadden'd in the spring, as if it had not been plowed at all. Yet this is the season in which the wheat ought to shoot with the greatest vigour; but instead of that, we often see its leaves turn yellow, its stalks dwindle, and the plant in a languishing state. Wheat sometimes looks better in the spring in a middling soil, than in one better adapted to that plant; because the latter grows stiffer and harder than the former.

Plowings, at proper seasons, will supply the wants of plants, preserve them green and in good condition, and destroy the weeds in the alleys. But the plough cannot reach those which grow between the rows, or in the beds. For this reason it is necessary to destroy the weeds as much as possible before the land is sown: and it will be easier for the weeders to root them out of the beds without hurting the corn, by following the new husbandry, than by the old.

Mr. Tull mentions several experiments which prove, 1. That wheat grows better in land plowed according to the new husbandry, without being dunged, than in land equally good and well dunged, but cultivated in the old way.

2. That a field which had been under wheat the year before, yielded a better crop of the same grain, by means of his horse-hoeing husbandry, than a field of equal goodness did after a fallow.

3. That land cultivated in his manner, requires no reſt; but on the contrary is better fitted for wheat every year, provided the ſame culture is continued.

To lay a field out for wheat, it muſt be plowed into beds, and the ſpace from the fartheſt ſide of one bed, to the neareſt ſide of the next, ſhould be five feet and a half, or at leaſt five feet *; obſerving to raiſe the middle of the beds as much as the depth of the ſoil will admit of. The more the beds are raiſed, the larger and deeper the furrows between them are; which is always of conſiderable advantage.

The beds which are intended for wheat, ſhould not however be raiſed ſo high as thoſe which are prepared for turneps; becauſe two or three rows of wheat are ſown in the ſame bed; whereas but one row of turneps is ſown. Thus the alleys between the beds of wheat, are not ſo wide as thoſe which remain between the beds of turneps.

It would be almoſt needleſs to ſay, that the beds ſhould be made length-ways of the field; that they ſhould be at equal diſtances, and either ſtraight or bending according to the ſhape of the field.

But it is proper to obſerve, 1. That it is always right to avoid having one part of the length of the beds wet, while another part is dry. For as land ought not to be plowed when it is very moiſt, the dry part of the bed muſt ſuffer, whilſt the other grows dry enough to be plowed: whereas by diſpoſing the beds in another direction, thoſe which are already dry enough, may be plowed, whilſt the others are drying.

2. If a field, which has been under wheat, be plowed with a deſign to ſow it with wheat a ſecond year, the beds muſt be formed in the middle of the former alleys, and raiſed pretty high, without touching the rows which bore the wheat. For if the ſtubble was mixed with the earth, it could not be ſowed by the drill-plough, nor plowed near the rows of wheat, without danger of rooting up many of the plants.

If, however, any good reaſon ſhould induce the farmer to alter the direction of the beds, he may do ſo, provided care be taken to cut the wheat very cloſe to the earth: for then the ſtubble, being very ſhort, will give little trouble when the ground is afterwards plowed.

* If from five feet and a half, you take one foot two inches for the bed, or ſpace whereon the wheat grows, there will remain four feet four inches for the breadth of the alley, which ſeems very ſufficient.

plowed: or, which is better, the wheat may be pulled up by the roots.

When wheat is to be ſown again in a field which has juſt produced wheat, as the new beds are to be in the middle of the former alleys, the plowman ſhould begin with cutting a very deep furrow in the middle of the alley, that ſo the wheat may have a greater depth of mould. This deep furrow is not only filled up afterwards, but the higheſt part of the bed is formed over it, avoiding the places where the ſtubble is, which are not to be levelled till the new alleys receive their firſt plowing. The inconveniences which might ariſe from mixing the ſtubble with the earth, are by this means avoided, and an uſeleſs labour is ſaved; for the wheat does not extend its roots during the winter ſeaſon, ſo as to reach the earth that is in the middle of the alleys.

There will, by this means, remain two ſmall furrows in each alley, betwixt the ſtubble and the new ſown wheat. Theſe furrows are of uſe to drain the water during winter: but they muſt be at ſuch diſtance from the rows of wheat, that the earth of the beds may not fall down into them. If the wheat has been plucked up by the roots, inſtead of theſe two ſmall furrows, there need only be one large one in the middle of the alleys.

Plowing, eſpecially of ſtrong lands, ſhould be avoided as much as poſſible, when the earth is wet. Inſtead of looſening the mould, it ſhould harden it. We know by experience, that where the bank of a ditch is made up with dry earth, it ſoon moulders down; whereas it will laſt years when it is raiſed with earth that is wet, or as it were made into mortar. So, if land is plowed when too wet, it will be ſo poached as ſometimes to require ſeveral plowings to recover it. I ſay ſometimes; for if great heats, which as it were bake the clods, are ſucceeded by rain, the clods crumble into duſt, in the ſame manner as quick-lime. Froſt has the ſame effect.

It may therefore be laid down as an almoſt general rule, that the ſeaſon cannot be too dry for plowing; and that the earth is always in fit condition to be plowed, if it be not ſo wet as to be poached.

When the earth is brought to a fine tilth, it ſhould be harrowed twice; taking care to keep the horſes in the furrows, that they may not trample and harden the ground on which the wheat is to be ſown.

Light lands may be ſown ſoon after harveſt; but ſtrong lands ſhould be ſown later; that is, towards the latter end of October: for

for if they were ſown ſooner, the ſurface would become ſo hard, that the corn would ſcarce be able to penetrate it. 'Tis one of the advantages of the new huſbandry not to be clogged with ſuch inconveniencies as to the time of ſowing. The ſowing muſt however not be delayed too long: for it is neceſſary that the wheat ſhould acquire ſome degree of ſtrength before winter, that it may be the better able to bear the inclemency of that ſeaſon.

As the corn that is cultivated in the new way, generally ripens later than that in the common huſbandry, it is right to ſow it early.

It is proper to ſow a greater quantity of ſeed in light lands, than in thoſe which are ſtronger: but all extremes ſhould be avoided. If it is ſowed too thick, many of the ears will be ſmall: if ſowed too thin, there will not be enough to occupy the ground. It is even ſaid, that it will ſhoot too much into blades, that it will ripen too late, and be in danger of being blighted. But, as it is a matter of ſome indifference, whether there be a little more, or a little leſs ſeed in a field, the preciſe quantity which is neceſſary may be eaſily aſcertained, if the drill plough is uſed; and thereby near three fourths of the ſeed corn employed in the common way, will be ſaved.

The depth at which the ſeed ſhould be ſown, depends on the nature of the ſoil. It muſt be buried deeper in a light, than in a ſtiff ſoil. The depth of half an inch will be ſufficient in the laſt; and it may be ſowed three inches deep in the other. As by the new huſbandry ſtiff ſoils are reduced to a fine mould, it is eaſy with the drill plough to ſow the ſeed at what depth is thought moſt proper.

The different kinds of wheat being already well known to farmers, we ſhall not enter into that detail, but proceed to give directions how the land is to be ſowed according to the new method.

Two, three, or four rows of wheat may be ſown at the diſtance of ſeven or eight inches from one another. If three rows are ſown at the diſtance of ſeven inches from each other, there will remain four feet four inches for the breadth of the alleys between the beds.

When land is ſowed which is apt to produce many weeds, there ſhould be but two rows, at the diſtance of a foot from each other; becauſe they are then more eaſily weeded; or, if the great number of weeds renders hoeing neceſſary, the diſtance of a foot will admit of it.

When the land is free from weeds, three rows may be ſown in a bed at the diſtance of eight or nine inches; experience having taught that if the diſtance of the rows is greater, the middle row is too long before its roots reach the plow'd earth in the alleys; and if they are ſown at a leſs diſtance, the roots interfere with one another.

Four rows of wheat ought not to be ſown in the ſame bed, except the ſoil is very rich, of a good depth, and free from weeds. For it is then more neceſſary to raiſe the beds high, that the roots being able to pierce deeper into the earth, may more eaſily extend themſelves into the alleys, where they meet with a rich fine mould: but upon the whole it is beſt to ſow only two or three rows.

The earth ſhould be ſomewhat moiſt when wheat is ſow'd; and the ſurface ſhould be ſettled before the froſts begin, that the cold may penetrate leſs deep. The rains which fall after the ſeed time, uſually ſettle it ſufficiently, without having recourſe to other means.

When the wheat has produced four or five blades, the alleys are firſt ſtirred with the horſe-hoe; for the former plowings were only to prepare the bed where the corn now grows. This hoeing conſiſts in filling up the great furrows, and making little ones to drain off the water from the beds. But they muſt not be cut too near the rows, eſpecially in light lands, for fear the earth of the beds ſhould moulder down into them, and thereby leave the roots of the wheat uncovered and expoſed to the froſt.

The ſmall ridges formed in the middle of the alleys, will mellow the earth during the winter, and thereby render it fitter for nouriſhing the plants in the ſpring: for the froſt which enlarges the dimenſions of the water that is mixed with the earth, powerfully divides the ſoil, and renders it extremely fertile.

The ſecond hoeing is given when the winter is paſt. This conſiſts in ſpreading the ridge in the middle of each alley, by turning the earth towards the beds; by which means one large furrow is made in the middle of each alley. However, if the ſmall furrows are a little diſtant from the wheat, the hoe may paſs once or twice near the rows, and the whole may be finiſhed by throwing the earth towards the beds as before. By this means, the earth mellowed by the winter, is brought nearer to the roots. If, during this work, ſome of the young plants happen to be buried by the earth, a woman may follow to uncover them with her hands.

It is the general opinion that dung ſhould remain near the ſurface of the earth; becauſe the nutritive juices which it contains, will penetrate into the earth with the water which diſſolves them. This may be true with reſpect to dung: but as the rain water cannot rob

a rich

a rich ſoil of its nouriſhing particles, it cannot be placed better than at the depth to which the roots of the plants deſcend. This is done by the ſecond horſe-hoeing.

It is not eaſy to fix the number of hoeings which ſhould be given to wheat between ſpring and harveſt. That depends on ſeveral circumſtances.

1. More hoeing is required when the land was not in fine tilth before it was ſowed, than if it was in proper order.

2. Where great numbers of weeds are apt to riſe.

3. Poor and ſtrong ſoils require more frequent hoeing than fat and fruitful ſoils.

4. The alleys ſhould be hoed as often as their mould begins to grow hard; always avoiding to touch ſtrong ſoils when wet.

Another general rule is, that the plough cannot go too deep near the plants while they are young, provided they are not torn up by the roots: for no inconvenience will attend the breaking of the extremities of their roots. When the plants are grown larger, the hoe muſt not go very deep near them, for fear of breaking their great roots: but the middle of the allevs cannot be hoed too deep; not only for the benefit of the plants actually growing, but likewiſe to provide a deeper mould for the enſuing crop.

Tho' the number of ſummer hoeings cannot be exactly fixed, two are generally found ſufficient: the firſt when the corn ſpindles, and the ſecond when the ear begins to fill. In both theſe hoeings, the earth muſt be turned towards the beds, and the furrow in the middle muſt be enlarged.

The winter hoeing ſerves to ſtrengthen the young plants; and by this means they often branch out into thirty or forty ſtalks each, inſtead of two or three which they bear in the common huſbandry.

The ſecond, or ſpring hoeing, greatly enlivens the plants, at a time when they are uſually yellow and weak, and at which they ought to be ſtrong, and able to ſupply their young ſhoots with proper nouriſhment.

The ſummer hoeings enable each ſtalk to bear fruitful and long ears; whereas in the common huſbandry, half the ſtalks do not bear any ears, or but very ſmall ones. Not only all the ſtalks bear ears in the new huſbandry, but theſe ears are long, thick, and loaded with grain.

A ſingle grain of wheat planted in a garden, has produced 80 and ſometimes 100 ears. If, one with another, each ear contains 50

L 2 grains,

grains, it follows that a ſingle grain is capable of producing 5000. It is certainly for want of due culture, that every grain of wheat which is ſown in the earth, does not produce ſo extraordinary an increaſe. A whole farm cannot indeed be ſo perfectly cultivated as a ſmall ſpot in a garden may be, where only a few plants are raiſed: but by means of the new huſbandry, 30, 40, or at moſt 50 grains, ſown in a ſquare of nine feet, have yielded 250 ears; and of theſe ears ſome were eight inches long, and contained 109 grains. If all the ears had been equally fruitful, the increaſe would have been 6000 for one: but as all ears are not equally furniſhed with grain, we may reckon that if one grain in the common huſbandry yields ten, in the new huſbandry it will yield an hundred. The produce of the ſame extent of ground will be double in the new huſbandry, to what it is in the old; not from the number of plants, becauſe much leſs wheat is ſown, but from the number of ſtrong ſtalks, and the length of ears full of grain, ſo large that fewer of them fill a meaſure, at the ſame time that they yield more flour.

There are other conſiderable advantages attending the new huſbandry. Little or no dung is employed: the earth is not reſted: it is not taken up with grain of leſs value, nor is the expence increaſed; for the culture which is beſtowed upon the corn whilſt growing, prepares the ground for the enſuing crop, and only two thirds of the ground is plowed. This horſe-hoeing anſwers the end of the four plowings given during the year of fallow: they are even more beneficial: for it has been obſerved, that the third crop of a field which was ſown with wheat five years running, was a twentieth part greater than either of the preceding crops, and that the fifth was the beſt of all.

The farmer muſt not therefore repine at the ſeeming loſs of the alleys, ſeeing that his lands are conſtantly employed, and that the wheat branches out into ſo many ſtalks, that, if ſpread equally over the whole field, as in the common huſbandry, they would nearly cover all the alleys.

CHAP. XV.

Of the Advantages of the New Huſbandry.

TO form a juſt idea of the advantages of the culture which Mr. Tull propoſes, we muſt not conſider whether each grain of corn that is planted in the new way, produces a greater num-

number of grains, than it would do by following the old method.

This comparifon would be too favourable to Mr. Tull. Neither muft we content ourfelves with examining whether an acre of ground cultivated according to the new principles, produces much more than the fame quantity of land cultivated in the common way would do. In this, the new hufbandry might perhaps not have any great advantage over the old.

The way to draw a right parallel between them, is,

1. To examine whether all the lands of a farm produce, upon the whole, more corn when cultivated according to the principles of the new hufbandry, than the fame quantity of land would do, if managed in the old way.

2. To confider whether the new hufbandry does not require fo much more expence than the old, as to counter-balance or exceed the profit that may be expected from it.

3. To be certain which of the two methods is leaft liable to thofe accidents by which crops are fo frequently damaged.

To the firft of thefe articles, Mr. Tull fays, that the fame quantity of ground, for example, an acre, will produce much more corn when cultivated according to his principles, than if it were managed in the old way. Let the ftalks of the wheat which grows in the beds, fays he, be diftributed over the alleys, and the whole furface of the ground will be as well covered as it generally is in the old hufbandry; but the ears will be much longer and fuller of fine plump grain, which will render this crop by much the moft advantageous.

It will, doubtlefs, not be readily conceived, that three rows of wheat placed in the middle of a fpace of ground five feet wide, can poffibly, by their fertility, fupply the deficiency of all the reft of that ground on which there is no wheat; and Mr. Tull may therefore be fufpected of exaggerating the advantages of a culture of his own invention. I will not difpute this point, if it be infifted on; notwithftanding the great probability of his arguments in fupport of it: but, on the other hand, it muft be allowed that, in the common way, one third of the land is refted during the year of fallow, and produces nothing; another third is occupied by grains lefs valuable than wheat; fo that only one third of all the lands of moft farms, is defigned for wheat.

According to the new method, all the lands are fowed with wheat: and though only fourteen inches are employed out of every breadth of four feet and a half, or five feet; yet, as the roots extend conſiderably farther, one third of the whole may be ſaid to be under corn. The queſtion then is, whether theſe rows of wheat produce a ſufficient quantity of grain to make amends, not only for the want of the crop of oats, which farmers generally reckon worth one third of a crop of wheat, but alſo to indemnify the farmer for his trouble. The experiments which we ſhall give hereafter, will prove that they do.

To the ſecond article, Mr. Tull ſays, that the culture of land in his way, coſts leſs than in the old huſbandry. This is true of an equal quantity of ground cultivated each way: but as, in the new huſbandry, all the lands of a farm are to be cultivated, and in the old huſbandry, the third part receives no culture whilſt under wheat, and the third that is under oats, is generally plowed but once, there is but one third of the farm which receives a thorough culture, and that is the part which is under fallow for wheat. In this light, it is not poſſible but that a farm muſt coſt more in cultivating it according to the new huſbandry, than the old. The only queſtion again is, whether the greater produce in the new huſbandry, will recompenſe the additional charge.

With regard to the third article, it may be obſerved, that while the corn is in the ground, it is expoſed to many accidents, ſome of which cannot be prevented: ſuch as hail, which breaks it down; violent winds which make it ſhed, perhaps the very night before it is reaped; continual rains, which make the ripe grain grow; ſevere froſts in the winter, which damage the roots, and untimely froſts which hurt the ears when ſpindling; hot glooms which mildew the corn, &c. It does not appear that any culture can prevent theſe accidents: but we ſhall ſhew in the articles of the diſtempers of corn, and of weeds, which ſometimes rob us of a third of our crop, that they are leſs to be feared in the new huſbandry, than in the old.

CHAP. XVI.

Of the Diſtempers of Corn.

MR. Duhamel is much more diſtinct in his account of the diſtempers of corn, than any Engliſh writer has hitherto been. Though they may be reduced to *mildew*, *blight*, and *ſmut*, he has diſtinguiſhed

diſtinguiſhed them by ſeveral other names, which we ſhall endeavour to explain as they occur; and, taking them in the above order, we ſhall begin with the

MILDEW;

which the French call *roüille*, or *ruſt*.

THIS diſtemper attacks the blades and ſtems of corn. It covers them with a powder of the colour of ruſt of iron, whilſt they are in their greateſt vigour. This ſubſtance does not adhere ſtrongly to the blades: for I have frequently ſeen the hair of white ſpaniels full of this powder, after they have run through a field attacked with this diſeaſe. It is likewiſe known, that if the infected corn is waſhed by a plentiful rain, the *ruſt* diſappears almoſt entirely, and the grain ſuffers little from it. Farmers give it the name of *ruſt*, from the colour of the powder; and it ſeems to be the ſame diſtemper which the Roman writers call *rubigo*.

This *ruſt* is uſually imputed to dry gloomy weather happening whilſt the corn grows with the greateſt force. I have many times obſerved, that when a hot ſun ſucceeds ſuch dry hazy weather, the corn was covered with *ruſt* in a very few days.

This diſtemper is of very bad conſequence; for the fineſt corn is ſuddenly brought almoſt to nothing, when it is entirely attacked with it.

If *ruſt* attacks the corn whilſt young, before the ſtem begins to riſe, the hurt is leſs, provided there comes on a ſeaſon kindly to its farther growth. The plants are only weakened, as if they had been fed or mowed. They ſhoot out anew, and produce ears. The ſtraw is ſhort, and the ears are ſmall. But if both blades and ſtalks become ruſty, the farther growth of the plant is ſtopt, and the grain gets no more nouriſhment; ſo that the crop is exceedingly diminiſhed.

This diſtemper is well worthy the attention of every inquirer into nature, who intereſts himſelf in the ſucceſs of farming.

The learned Mr. Tillet, director of the mint at Troyes, treats of this diſtemper, but only occaſionally. He thinks it is cauſed by a ſharpneſs in the air in dry cloudy weather, which breaks the veſſels interwoven with the ſubſtance of the blades and ſtem, and makes them diſcharge a thick oily juice, which, drying by degrees, is turn'd into that ruſty powder. He has examined, with a good microſcope, many

many plants of corn whofe ftems and blades were covered with *ruft*, and faw diftinctly many fmall openings in the membrane covering the plant, where the powder lay. He obferved that the juice, now dried to a powder, iffued from thefe fmall openings, over which he ftill perceived fome pieces of the membrane, which imperfectly covered the openings.

This diftemper is called *mildew* in England. Our air is feldom fo dry as to exhale all the moifture of the glutinous exfudations, and thereby convert them into the rufty powder above defcribed. The caufe here affigned, feems much more reafonable than the thick clammy dews which fome of our authors mention, as falling in clofe weather, ftopping the perfpiration of plants, and hindering the fap from afcending to nourifh the flowers, *&c.*

Mr. Tillet, in fupport of his opinion, quotes a memoir of Mr. Reneaume, publifhed in the Tranfactions of the Academy of Sciences, on the extravafation of the nutritive juice of Wall-nut trees in Dauphiny, of the manna of Calabria, which is not a dew, but the extravafated juice of the leaves of a kind of afh, and what Mr. Mufchenbroeck relates in his Phyfical Effays, of thick and oily juices, which iffue out at the excretory veffels of leaves, and ftop there in the confiftence of honey.

Mr. Tillet, from feveral facts which he mentions, concludes that the *ruft* or mealy powder which is obferved on many plants, is not a collection of the eggs of infects; but that it depends on the quality of the juices of particular plants, when the thinner parts are evaporated. Thus, it is red on garden-beans, of a rufty colour on all kinds of corn, greenifh on the plum, yellowifh on the afh, white on larch trees, *&c.*

We have frequently tried to produce the fame effects which the dry weather occafions, by applying to the leaves of many plants, acid and corrofive liquors, to others alkaline and fpirituous liquors, and frequently fuch clammy glutinous fubftances as might ftop the perfpiration, without hurting the texture of the plants. Thefe trials have not produced any thing like ruft. But who can tell how far experiments may lead philofophers? Some little circumftance may have efcaped us, which, obferved, might have led us near the object of our fearch. The public welfare calls on all attentive obfervers, to exert themfelves on fo ufeful a fubject.

Mr. Worlidge's opinion of *mildews*, which he holds to be quite different things from *blights*, is, that they are "caufed from the condenfation

" denſation of a fat and moiſt exhalation in a hot dry ſummer, from
" the bloſſoms and vegetables of the earth, and alſo from the earth
" itſelf, which, by the coolneſs and ſerenity of the air in the night,
" or in the upper ſerene region of the air, is condenſed into a fat
" glutinous matter, and falls to the earth again; part whereof reſts
" on the leaves of the oak, and ſome other trees whoſe leaves are
" ſmooth, and do not eaſily admit the moiſture into them, as the
" elm or other rougher leaves do; which *mildew* becomes the prin-
" cipal food of the induſtrious bees, being of itſelf ſweet, and eaſily
" convertible into honey.

" Other part thereof reſts on the ears and ſtalks of wheat, be-
" ſpotting them with a different colour from what is natural; and,
" being of a glutinous ſubſtance, by the heat of the ſun, doth ſo bind
" up the young, tender and cloſe ears of the wheat, that it prevents
" the growth and completing of the imperfect grain therein; which
" occaſioneth it to be very light in the harveſt, and yield a poor and
" lean grain in the heap.

" But if after this *mildew* falls, a ſhower ſucceeds, or the wind
" blow ſtiffly, it waſheth or ſhaketh it off, and are the only natural
" remedies againſt this ſometimes heavy curſe.

" Some adviſe in the morning, after the *mildew* is fallen, and be-
" fore the riſing of the ſun, that two men go at ſome convenient
" diſtance in the furrows, holding a cord ſtretch'd ſtreight between
" them, carrying it ſo that it may ſhake off the dew from the tops
" of the corn, before the heat of the ſun hath thickened it.

" The ſowing of wheat early hath been eſteemed, and doubtleſs
" is the beſt remedy againſt *mildews*, by which means the wheat
" will be well filled in the ear before they fall, and your increaſe
" will be much more. For curioſity ſake, wheat was ſown in all
" the months of the year: that ſown in July produced ſuch an in-
" creaſe as is almoſt incredible. In France, they uſually ſow before
" Michaelmas.

" Bearded-wheat is not ſo ſubject to *mildews* as the other, the
" fibres keeping the dew from the ear."

Mr. Miller takes the true cauſe of the *mildew* appearing moſt upon plants which are expoſed to the Eaſt, to proceed from a dry temperature in the air when the wind blows from that point, which ſtops the pores of plants, and prevents their perſpiration, whereby the juices of the plants are concreted upon the ſurface of their leaves, and being of a ſweetiſh nature, inſects are incited thereto; where, finding proper nutriment, they deposit their eggs, and multiply so fast as to cover the whole surfaces of plants, and, by their corroding the vessels, prevent the motions of their sap: and it is very probable that the excrements of these insects may enter the vessels of plants, and, by mixing with their juices, may spread the infection all over them; for it is observable, that whenever a tree has been greatly affected by this mildew, it seldom recovers it in two or three years, and many times never is entirely clear from it after.

Mr. Chateau-vieux, whose accurate and judicious experiments will form the most considerable and most useful part of this work, was for some years so much taken up in establishing the horse-hoeing husbandry, that he had not leisure to attend to the distempers of wheat, till the great loss he sustained in the years 1753 and 1754, by the *rust*, engaged him, not so much to inquire into the cause, as to discover a remedy for it.

He is of opinion, that the powder which forms the *rust* is the extravasated juice of the plants: because, as soon as the *rust* comes on, the growth of the plant is stopt, the blade becomes no larger, the stalks grow no higher, nor the ears any bigger. "The juices, says "he, still rise in the plant: they must therefore be turned to some "other use; and it appears probable to me, that they are converted "into this brown powder, which daily increases in quantity as long "as the distemper lasts. I cannot think it a substance foreign to the "plant, brought there by any external means.

"I have never seen corn struck with the *rust*, but in very dry weather, "and (which is of importance to be observed) never but when there "has not been the least dew for several days.——May not the want "of that moisture, so friendly to vegetation, dry the surface of the "blades and stems so as to make them crack, and the vessels, being "broke, pour forth their contents?

"This opinion, continues he, is supported by an experiment which "I made; and which likewise teaches us how to stop the progress "of this distemper, when it seizes corn before it spindles.

"On the 6th of July, 1753, I planted 159 grains of the wheat "which I intended to use for seed. They did not begin to spring "up till the 20th. On the 18th of the same month, I sowed 104 "grains more. They sprouted soon, and had very large blades of a "deep green. About the end of August, the blades changed their "colour, and the *rust* soon appeared. It made an astonishing pro-"gress. The earth, for two feet distance from the rows, was co-

vered

" vered with the rufty powder, and towards the rows of the plants it
" lay at leaft one-twelfth of an inch thick. The blades were almoft
" entirely deftroyed, and the lofs of the plants feemed to me in-
" evitable.

" As I was perfuaded that this powder was the extravafated juices
" of the plants, I was in hopes that if I could turn the courfe of the
" juices from the diftempered blades, the plants might produce new
" blades and ftalks; as I obferved that they were perfectly found
" wherever they were covered by the earth.

" The experiment was eafy to be tried. It was only plucking off
" all the blades clofe to the earth; which accordingly I did on the
" 28th of September, from one half of my plants.

" New blades began to grow in a few days after this operation.
" The plants throve greatly, and before the beginning of winter,
" were again in full vigour. In the fpring, they branched abun-
" dantly, and produced large ears, which ripened kindly.

" The *ruft* continued its havock on the plants which I had not
" ftripped of their blades, till they were entirely killed. They did
" not produce a fingle ear.

" This remedy can only take place when the diftemper happens
" in the autumn or fpring: but if it happens later, when the ftems
" are grown, and the ears are ready to break forth, it feems to me
" then incurable.

" I have often obferved, that the corn which is fown very early is
" more fubject to this diftemper than what is fown later.

" If we were acquainted with the caufes of this *ruft*, it might
" be more eafily prevented. In order to acquire this knowledge,
" the lovers of hufbandry fhould collect every obfervation they make
" on this diftemper, whence fome ufeful hints may arife.

" I obferved, that when the wheat was rufted in the autumn of the
" years 1753 and 1754, the fecond crop of hay was fo too. The
" grafs turned, from a beautiful green, to that rufty colour which
" the corn had: it was covered with the fame kind of powder, and
" diminifhed fenfibly every day; and, as the whole of a field of
" wheat is not, ufually, affected at the fame time, fo it extended
" only to fome parts of the meadow.

" This diftemper in grafs, is undoubtedly owing to the fame caufe
" as it is in corn, tho' its effects are different on each. It entirely
" deftroys annual plants, as in my experiment; but in grafs, which
" is a lafting plant, it deftroys only the leaves, and the roots after-

"wards produce new blades; or perhaps the plants are preferved, by "the blades being taken off in cutting them for hay. This is only "conjecture: but as it is a matter of importance, I fhall be more "careful in my future obfervations.

"It is well known that bread made of rye which has been attacked "by the diftemper called *ergot*, is unhealthy, and caufes very trou-"blefome difeafes.———Is there not fome reafon to fear the fame "bad effects from feeding cattle with fodder which has been *rufted*? "May not this be the caufe of deadly diforders which fometimes cut "off whole herds, and for which no remedy has yet been found? "Thefe difeafes are fometimes reckoned contagious; perhaps on too "flight an inquiry.

"This fear of the pernicious effects of diftemper'd fodder, may be "groundlefs, though it is founded on plaufible appearances. It "were to be wifhed for the public good, that where fodder is any "way diftemper'd, by ruft, fmut, &c. fome part of it, the moft di-"ftemper'd, were fet apart, to feed fome cattle with, that we might "be affured whether their health is affected, or difeafes are brought "on by it. If cattle fed with it for two or three months, continue "in good health, it may afterwards be made us with confidence. "If we find them droop, the remedy is at hand: they muft be fed "with good wholefome hay, which will carry off the difeafe, then "known to proceed from the bad quality of their food."

OF BLIGHTS.

WHAT we exprefs in England by the general term, *blight*, our author divides into different kinds, appropriating a particular name to each. The firft he fpeaks of, he calls

Coulure, i. e. *Empty-ears*.

CORN is faid to be *coulé*, when the ears, inftead of being full of plump grains, are entirely deftitute of any in their extremities, or contain only a few fmall grains, in which there is fcarce any flour, and which pafs through the fieve, with the duft and feeds of weeds.

This may be owing to feveral caufes.

1. Heavy and cold rains, when the corn is in bloom, may prevent the grains being render'd pregnant, as it happens to grapes, in the fame circumftances, which remain fmall and without juice.

2. Others

2. Others impute this evil to lightning, which ſeems probable from the known and great effects of electricity, with which the air is ſo abundantly ſtored in ſtormy weather. I have ſeen trees loſe all their leaves after a ſtorm, and others die entirely, which could be imputed only to the lightning: but as the next neighbouring trees are not hurt when any thing of this kind happens to corn, it can ſcarce be of any great extent.

3. The ears are ſometimes hurt by froſt, juſt as they come forth. In this caſe, the ears which are entirely frozen, contain no grain; and if only the extremity is frozen, that part is without grain.

4. If, by accident, the growth of the plants is interrupted whilſt the grain is forming, that in the extremity of the ear, which is formed laſt, will ſuffer moſt. The frequent ſtirrings given the mould in the new huſbandry, keeping the corn always in vigour, the grain will be formed more perfectly through the whole length of the ear; and therefore corn raiſed in this manner, will be leſs ſubject to this diſtemper, than any other.

I collected ſome handfull's of ſuch ſmall grains of wheat found in the extremities of the ears, and having ſowed them, they almoſt all ſprouted, and moſt of them produced very fine corn. This ſhews that the ſmallneſs of the grain is not always owing to its want of being impregnated.

What M. Aimen names *barrenneſs in corn*, may be included in this diſtemper. He ſays that when, by froſt or any other cauſe, the male or female organs in plants are rendered incapable of performing their functions, the plants yield no fruit, tho' they otherwiſe look well: and he confirms his opinion by a quotation from Theophraſtus to the ſame purpoſe. A bright ſun, after heavy rains, he ſays, produce this effect; and he thinks it is but ſeldom, though ſometimes, cauſed by inſects.

Bleds echandés et retraits: i. e. *Parched and ſhrivell'd corn.*

CORN is ſaid to be *parch'd* and *ſhrivelled*, when, inſtead of being plump, ſmooth, and full of flower, it appears wrinkled in the outward ſurface. It is true theſe grains yield good flour, which makes pleaſant bread: but the flour is in ſmall quantity, ſo that two ſacks of this ſhrivell'd wheat ſhall yield perhaps no more flour than one ſack of ſound plump wheat. Yet, if the corn is not greatly diſtemper'd, it ſprouts very well, and may do for ſeed-corn.

This appearance in corn is occaſioned by whatever prevents the

free

free aſcent of the nouriſhing juices into the grain when it is almoſt formed. The following ſeem to be the chief cauſes.

While the corn is yet green, if great heats come on, the ſtalks dry, and the grains ripen too ſuddenly, without being filled. This is frequently the caſe when heats ſucceed a rainy ſeaſon, which fills the plants with too much moiſture. Sometimes the grain contains no flour at all.

By the new huſbandry, wheat preſerves its verdure at leaſt a week longer than in the common way, which is a great advantage, becauſe the grain has time to be duly formed, and to be filled with flour. Corn ſown according to the new huſbandry, being later in bloom than that which is ſowed in the common way, is ſo far more liable to the danger of great heats. This is therefore a good reaſon for ſowing earlier, that it may bloom as ſoon as in the common way.

It is not poſſible to prevent the effects of lightning or of froſt, nor to alter the cauſes which hinder the grain's being impregnated. But by means of the new huſbandry one conſiderable cauſe of this ſhrivelling of the wheat may be guarded againſt.

When corn is lodged whilſt the grain is yet milky, the juices cannot flow freely through its ſtalks which are then either broken or greatly bent. The grain which receives no more nouriſhment, ripens without being filled with flour.

It is not the weight of the ears which makes the corn lodge. If the ſtalk is large and ſtrong, it will ſupport the ear, be it ever ſo full of grain. But to give it that ſtrength, it is neceſſary that the air and ſun ſhould have free acceſs to it, and that the plant have ſufficient nouriſhment while it is in the earth.

In the common huſbandry, the plants have leſs nouriſhment; and as the ſtalks ſtand thick together, ſmothered and covered from the ſun, they are tender and brittle. But in the new huſbandry, every ſtalk receiving abundant nouriſhment during the whole time of its growth, and being always expoſed to the air and ſun, it becomes large and ſtrong enough to ſupport the ear.

It is agreed, that corn which grows in a rich ſoil, is tall, and more liable to be lodged, than what is ſtinted in its growth. But this is owing to the weakneſs of the ſtraw, and not to the weight of the ears. We frequently ſee that tufts of wheat which grow in vineyards and other places, expoſed on all ſides to the ſun and air, are leſs ſubject to be laid than tufts which grow in the middle of large fields. Farmers finding that their corn on the richeſt land is moſt

liable

liable to be laid, cauſe it to be eat down when it is very rank, or mow it, in order to bring it to a level with the weak and ſhort, and prevent its being lodged at harveſt. This practice is very wrong; for the farmer thereby leſſens his crop, or brings it on the level of a ſecond crop, where the ears are always ſmall and light. They are afraid of the grain's ſhrivelling, if the corn is lodged; and, to avoid that inconvenience, they have recourſe to means which will certainly render the ears ſmall and leſs ſtored with grain. Beſides, the grain is generally good when it ripens in due ſeaſon: but by feeding or cutting down the corn, its growth and ripening are retarded, by which means it is expoſed to all the inconveniencies of a late harveſt.

It will hereafter appear by many repeated experiments, that if the plowman is careful to turn the earth towards the rows of corn, at the laſt hoeing, thereby to give greater ſtability to the ſtalks when they have attained their height, the corn will be leſs liable to be lodged.

Mr. Tull obſerves, that in cold countries there are inſects which prick the ſtems of wheat before the grain is full of that milky ſubſtance which forms the flour. Theſe inſects lay their eggs on the outward covering of the ſtalks, and when thoſe eggs are hatched, they feed on the pith, and deſtroy many of the veſſels, whence the grain, being deprived of part of its nouriſhment, remains light and ſhrivell'd.

The attack of theſe inſects may be known by the black ſpots, thought to be their excrements, which are ſeen on the ſtalks.

When theſe inſects do not damage the ſtalks till the grain is well filled, they do little hurt. For this reaſon, early corn is leſs ſubject to be attacked by them, than that which is late; and as the wheat that is firſt ſown generally ripens the ſooneſt, this is another reaſon for ſowing early.

As it is obſerved that theſe inſects chiefly attack the moſt thriving corn, perhaps becauſe its ſtalks are the moſt juicy, one would imagine that as the wheat which is cultivated according to the new huſbandry is more vigorous than any other, it ſhould likewiſe be more ſubject to be injured by them. Mr. Tull ſays, that in this caſe, a deep furrow may be cut near the wheat, about the middle of June, in order to cut the roots of the plants, and thereby leſſen their luxuriancy. It does not appear that he ever tried this remedy, which ſeems very dangerous. As the ſtraw is expoſed to the air and ſun,

ſun, in the new huſbandry, it may probably contract a hardneſs which does not ſuit theſe inſects, ſince they are never ſeen in dry ſeaſons.

Mr. Tull adviſes a better ſafeguard againſt theſe inſects, *viz.* to ſow the white bearded wheat, the ſtalk of which is not hollow, but towards the foot, the reſt being filled with pith. It is ſuſpected that they ſometimes attack this corn too, by the black ſpots which are obſerved on the ſtraw: but it is known by experience, that the grain never ſuffers thereby, being always plump, hard, and heavy.

As I have never ſeen any of theſe inſects, I can ſay nothing farther concerning them.

Bled glacé. i. e. *Glazed Corn.*

MEN ſkilled in wheat require that it be heavy, of a ſmooth ſurface, and bright yellow colour. If it is of a dead white, they judge it to be watry, *moüîllé*; and if of a deep yellow, and inclining to be tranſparent, it is ſaid to be *glacé*, *glazed*. This fault happens to corn that has been ripen'd by great heats, which have come before the flour was formed. This wheat ſprouts well, yields plenty of flour, and makes good bread. I gueſs that this flour does not take ſo much water to knead it, as the flour of the beſt wheat does. This is the only diſadvantage attending it, if it really be one.

Bled avorté. i. e. *Abortive, or Rickety Corn.*

OUR author ſays he did not know this diſtemper in corn, till he had ſeen M. Tillet's memoir on that ſubject; but that he has ſince obſerved it. The following is the ſubſtance of that memoir, being a diſſertation which gained the prize given by the academy of Bourdeaux.

1. The abortive ears grow on rickety ſtalks, of a white colour, with curled leaves.

2. The ſtalks appear rickety as ſoon as they are three or four inches high.

3. Whilſt the rickety ſtalks are yet low, they are weak, and of a yellowiſh hue: their blades are of the ſame colour, and ſomewhat crimped or curled, as if they were blighted; and towards the root, the rickety ſtalks look ſtronger than others.

4. As the rickety ſtalks grow, they become of a green colour, and afterwards change to that blueiſh hue which is their diſtinguiſhing

ſtinguiſhing character: their blades remain curled, become likewiſe blueiſh, and never have the ſtrength and conſiſtence of ſound blades.

5. This is not a diſtemper peculiar to corn growing in a poor ground. M. Tillet has obſerved it in corn growing in a rich ſoil, and even in the middle of a tuft of fine wheat. He has ſometimes ſearched for it in vain in poor ſoils, where the corn was but in a languiſhing condition.

6. The roots ſeemed to partake of the ſame diſtemper. They were not entirely covered with their ſoft ſpungy coat, and in ſome parts they were grown hard like wood.

7. Rickety ſtalks ſeldom bear ears, either entirely good or entirely bad. When the ears are good, they grow on upright ſtalks, with blades a little curled.

8. The abortive grains reſemble very young peas, and have ſometimes one, two, or three ſpots in thoſe which are quite formed, ſo that they look like two or three grains joined together.

9. Abortive grain, which uſually grows on rickety ſtalks, is ſometimes mixed in the ſame ear with ſmutty grains, which laſt generally grow on upright ſtalks, whoſe blades are not curled. Of *ſmut* hereafter.

10. Rickety ſtalks carry ears which ſometimes contain ſound grain, and at other times abortive grains.

11. The abortive grains are ſeldom at the bottom of the ear; for which reaſon they ſhed eaſily when the huſk or chaff is opened.

12. The bloſſoms of abortive grain are ſeldom duely formed.

13. The plants are ſometimes render'd quite abortive, before the corn ſpindles.

14. After the abortive ears have been ſome time expoſed to the air, they grow white, and the grains become black and dry.

15. We ſometimes meet with ſtalks of wheat, which, tho' of the rickety kind, are ſtrait and tall, and have only the blades of the third or fourth joint ſhrivelled or curled.

All theſe ſymptoms do not unite in the ſame ſtalk, but where the diſtemper is at the worſt. When the grain is ripe, or rather when it is dried, it turns black, and looks ſo like the ſeed of cockle, that many farmers, who are unacquainted with this diſtemper, confound the abortive grains with the ſeeds of that plant.

M. Tillet ſuſpects, that this diſtemper is occaſioned by inſects. He has found inſects on the diſtemper'd ſtalks, where he ſaw drops of a very clear liquid, which he took to be the extravaſated ſap.

ACCIDENTS occaſioned by INSECTS.

BESIDES inſects, which are properly the ſubject of this article, there are ſeveral other animals which do conſiderable damage to corn. Field-mice eat not only the grain, but oftentimes the plant itſelf. Rooks alſo deſtroy great quantities of corn with their ſtrong beaks, and hares and rabbits eat it whilſt green, and weaken the young plants, ſo that they branch but little and produce weak ears. Pigeons have not bills ſtrong enough to root up the grain when covered with earth, nor do they feed upon the young corn: they only pick up the grains that are not covered, and which muſt infallibly become the prey of other animals, or be dried up by the ſun. Partridges do no more harm than pigeons, for they do not ſcratch. They only eat the green corn, which can be of little conſequence, unleſs they are in great numbers indeed, and in a place where but little corn is ſown. Sparrows make great havock at harveſt time, by the vaſt quantity of corn which they eat, eſpecially near hedges or villages. Bearded wheat, and rye, are leſs their prey than any other grain. This is worth knowing: for it is better to have a full crop, even of rye, than to have half a crop of wheat eat by them, after being raiſed with great care. Small ſnails deſtroy a great deal of wheat in ſome ſoils.

But the loſſes occaſioned by ſuch creatures, are not what we propoſe to treat of here: we mention them only by the bye, and now proceed to the inſects.

There is a ſmall kind of worm, which gets into the roots, chiefly of oats, and, working upwards, deſtroys all the inſide of the plant, which periſhes ſoon after. I ſuſpect it to have been an inſect of this kind that deſtroyed ſo much wheat in the neighbourhood of Geneva, and which M. de Chateau-vieux deſcribes thus. "Our "wheat, in the month of May 1755, ſuſtain'd a loſs, which even "that cultivated according to the new huſbandry did not eſcape. "We found in it many little white worms, which afterwards be-"came of a cheſnut colour. They poſt themſelves between "the blades, and eat the ſtems. They are uſually found be-

"tween

" tween the firſt joint and the roots. Every ſtalk which they at-
" tacked, grew no more, but became yellow, and withered. The
" ſame misfortune happened to us in the year 1732. Theſe in-
" ſects appeared about the middle of May, and made ſuch havock
" that the crop was almoſt deſtroyed."

We too often find, in our kitchen-gardens, a ſort of vermin called *vine-fretters.* They fix upon the roots of leguminous plants, which gradually turn yellow, and die. M. Tillet ſays he has obſerved the ſame inſect in the roots of wheat. Meſſrs. de Reaumur and Tillet have likewiſe obſerved ſmall caterpillars which are hatched in the ears of wheat. I have myſelf long ago obſerved, and made drawings of ſmall inſects, ſome of a bright red, and others black, which are found in great numbers in the ears of wheat. I ſuſpect that theſe inſects feed on a ſweetiſh juice, which is in the ear whilſt green. As M. Tillet was at firſt of opinion, that they might do conſiderable damage to the grain, he followed with great attention all their metamorphoſes, of which he has given a full account in the before mentioned memoir.

Though inſects, and other enemies to corn, whilſt in the granary, do not properly belong to the preſent ſubject, I beg leave to give the following account, which was ſent me by a gentleman of Angoumois.

" The great loſs, ſays he, which we have ſuffered in this pro-
" vince in our corn, and eſpecially our wheat, for ſeventeen or
" eighteen years paſt, has put us upon making ſtrict inquiries into
" the cauſes of a corruption with which our grain is infected. The
" common opinion is, that when the corn is in bloom, that is to
" ſay, in the month of June, ſmall white butterflies lay their eggs
" in the flowers. When the grain is ripe, the eggs are incloſed in
" it. As ſoon as the corn is laid up to be kept, it is found to fer-
" ment. This fermentation raiſes a heat, which hatches the eggs,
" whence little worms proceed, which are transformed into chry-
" ſalides, and theſe are afterwards metamorphoſed into little grey
" butterflies, or moths. In this ſtate they quit the grain, which is
" then void of flower. This inſect not only ſpoils the grain in
" which it is hatched, but likewiſe communicates a moſt diſagre-
" able ſmell to all the grain near it; a ſmell which is ſometimes
" ſo ſtrong and nauſeous, that fowls, and even hogs, will not eat
" the grain.

" Others impute it to the *maize*, or Turkey wheat, which is "sown in great quantities in this province; and which spreads its roots "so far, and so impoverishes the earth, that other corn sown after "it, in the same ground, can find no nourishment. This is not "probable: for it could only alter the quality of the grain, but not "bring on an entire putrefaction.——The two following experi-"ments were tried to prevent it.

"A farmer had three or four arpents of land which had been under "grass for more than sixty years. He had plowed and dunged it "well. He had his seed from Poitou; and, in short, took every pre-"caution to guard against this contagion. The wheat ripen'd and "was very good. He cut it down in a dry season, threshed it in the "open air, and cleansed and winnowed it very carefully. It was "laid in a granary which had no communication with any other, "and which had an opening to the North. The farmer ordered it "not to be laid above three inches thick on the floor, and to be "turned twice a day. Four days passed before the least heat was "perceived; but on the fifth day, it began to grow a little warm; "and from that time the heat increased, notwithstanding every means "that had been, and still continued to be used. All that could be "done, was, to prevent its being so much spoilt as corn in general "was that year.

"The other experiment succeeded better. As soon as the wheat "was threshed, well cleaned and winnowed, it was put into an oven "heated to a certain degree. The floor of the oven was covered "with wicker hurdles, on which the corn was spread four inches "thick: the door of the oven was then shut, and remained 24 hours "without being opened. Many have followed this example. Their "grain has not changed: only its colour is not so bright: care must "be taken that the oven be not too hot: otherwise the bread made "of this flour will have a burnt taste. It is likewise necessary to "cover the bottom of the oven, lest the wheat should communicate "its taste to it.

"I confess that this operation is long and troublesome, where "a great quantity of corn is to be preserved; for only ten or twelve "bushels can be put into the oven at a time; and besides, it must "be done the moment it is threshed: otherwise it will infallibly "spoil."

I have not had an opportunity, says M. Duhamel, of inquiring into the cause of the accident here complained of: but as the oven has been found so effectual a preservative against it, it would certain-

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ly be right to make uſe of the ſtove of which I have given a deſcription in my treatiſe on the preſervation of corn. The method there adviſed, will not be ſo expenſive, nor ſo troubleſome as the ovens, and the price of making the ſtoves will bear no proportion to the advantages which will ariſe from the uſe of them.

Our author, like all the other French writers, divides the diſtemper which we call *ſmut*, into two kinds, *viz. Smut*, properly ſo called, and *charbon, coal,* ſo named from the wheat's looking as if it was burnt. He obſerves that it is of great conſequence to inquire into the cauſes of *ſmut* and *charbon*, becauſe we may perhaps arrive at the knowledge of effectual means to prevent theſe diſorders, which frequently occaſion ſuch great loſſes to farmers. He begins with

S M U T.

THE grains of ſmutty corn are tender and filled with a black ſtinking powder, inſtead of the white flour which ſound grains contain. As theſe grains are very eaſily broke: they ſpread their powder on the ſound grains, which having on their extremity a little tuſt of hairs, the powder ſticks there. Farmers diſtinguiſh the wheat thus vitiated, by ſaying that *it is blacked in the point*, (in French *qu'il a le bout,)* and bakers avoid it, becauſe it gives their bread a violet or purple hue.

As ſoon as the ſtalks begin to riſe, if the blades are opened ſo as to diſcover the young ear, it will be found to be already diſtempered; and in this caſe I have thought that I have obſerved the pith or inſide of the ſtalk already black.

As ſoon as the ear appears out of the covering which the blades form, it looks ſhrunk. All the coverings of the grain are ſo altered and ſhrivelled, that the ſmut appears through them. As the powder in ſuch grains has little coheſion, it is eaſily waſhed away by the rains, or carried off by the wind. If any of it remains, 'tis only on the points of the ſound grain.

When corn thus *blacked in the point* has been kept for ſeveral years, and frequently ſifted through an iron ſieve, this colour vaniſhes. I have even taken it off immediately, by rubbing it with a cloth: which ſhews that the impreſſion is only ſuperficial.

Smutty corn is ſo thoroughly deſtroyed, that it cannot grow or germinate. There is therefore no room to fear that the diſtemper'd grains can produce their like. The corn which is only black'd in the point, grows very well.

Smut is not only a diſtemper of the ear, but of the whole plant; and it very ſeldom happens but that when one ſtalk is ſmutty, all the other ſtalks from the ſame root are ſo too. I never found but one ſound ear on a diſtemper'd plant.

Authors are not agreed what the cauſe of this diſorder is. Some impute it to inclemencies of the weather when the corn is in bloom. It is certain that cold rains at that time prevents the grains being impregnated: but it is well known that grain which is not impregnated, does not always become ſmutty: and beſides, if it proceeded from any general cauſe, the whole would be affected; whereas there are ſometimes only a few ſmutty ears among the beſt corn. 'Tis true, it is moſt frequent in rainy years; and Mr. Tull is therefore of opinion, that it is not the rain, but the moiſture of the earth which occaſions it. "I was confirmed in this, ſays he, by ſeveral plants of "wheat taken up when they were in graſs in the ſpring, and plac'd "in troughs in my chamber window, with ſome of the roots in water. Theſe wheat plants ſent up ſeveral ears each, but at harveſt, "every grain was ſmutty; and I obſerv'd, none of the ears ever ſent "out any bloſſom. This ſmuttineſs could not be from any moiſture "that deſcended upon it, but from the earth, which was always "kept very moiſt. The wheat plants in the field from whence "theſe were taken, brought very few ſmutty grains, and much "larger ears than theſe."

This experiment would ſeem deciſive, if it had been repeated often enough. If the ſmut was occaſioned by the wetneſs of the earth, a much greater number of ſtalks would be infected in the lower parts of the ridges than in the higher, which I never heard to be the caſe.

The Rev. Dr. Hales, ſuſpecting that the ſmut might proceed from the ſeed's being bruiſed by the flail, took a number of grains of different ſizes, and bruiſed them with a hammer. They ſprouted and grew very well, without any ſmutty ears. This moſt ſkilful philoſopher concludes from thence, that this is not the cauſe.

After the publication of Mr. Duhamel's firſt volumes, the academy at Bourdeaux propoſed for the ſubject of their annual prize, *the beſt account of what renders black the mealy ſubſtance of grain.* Of the many that were given in, our author mentions only M. Tillet's, which carried the prize. He likewiſe gives the ſubſtance of a memoir preſented to the royal academy at Paris by M. Aimen, M. D.

Both theſe gentlemen give, if I may be allowed the expreſſion, an

accurate

accurate anatomical account of this diſtemper, drawn from obſervations founded on their knowledge of the ſtructure of plants. But as thoſe diſquiſitions are rather curious, than uſeful to farmers, we ſhall give only their practical remarks, referring the learned in theſe matters to the Original, or rather to the Original Memoirs in the Tranſactions of both the Academies.

In anſwer to Mr. Tull's allegation that too much moiſture is the cauſe of ſmut, M. Tillet planted a tuft of wheat in a veſſel in which he kept the earth extremely moiſt, and had not one ſmutty ear.

He is of opinion that it does not proceed from any inclemency of the weather, or want of impregnation; becauſe it takes place before the ears have appeared.

M. Aimen gives the following, as the ſigns of its firſt appearance.

1. The ſheaths of the ears of ſound corn are larger and more ſwelled, eſpecially towards the middle, than the ſame parts are in the diſtempered ears.

2. The diſtemper'd ears have a ſmell like red herrings.

3. As ſoon as the diſtemper'd ears begin to ſhoot forth, and the beards appear, it is eaſy to diſtinguiſh them from the ſound; for their beards are whitiſh, whereas the ſound ones are green.

He obſerved ſome ears which were quite ſmut in the lower part, whilſt the upper part was very little damaged. The diſtemper in this ſtate does not affect the ſtraw, the external part of the ear, or the ſtalk which runs through the middle of the ear. Wheat, oats, barley, ſpelt, and ſeveral kinds of dog's graſs are liable to this diſtemper, and rye is not entirely free from it.

M. Aimen is of opinion that the ſmut is produced by an ulcer which ſeizes the different parts of the bloſſom. He has ſpared no pains to diſcover the cauſe of this ulcer. He is well aſſured that it is not cauſed either by inſects, or by the wetneſs or dryneſs of the ſoil; nor does it ſeem to ariſe from any fault in the juices, ſeeing that all the reſt of the plant is pretty well formed.

He ſowed corn blighted in all degrees, which either did not ſprout at all, or produced ſtalks more or leſs vigorous, but all of them free from ſmut. He ſowed ſome mouldy grains, each of which produced ſmutty ears.

M. Aimen thinks he has reaſon to believe that grain may become mouldy in the earth. He ſowed ſome choſen grains, and when they had all ſprouted, he took them up, to examine them with a microſcope. He found ſmall white threads or filaments on ſome of them.

He

He planted them again, and theſe plants produced ſmutty ears. This experiment was repeated, with the ſame ſucceſs.

It is hard to conceive that mouldineſs, or, if you will, a kind of moſs, can produce ſmut: for as ſoon as the grain has ſprouted, and the plant is formed, the whole ſubſtance of the ſeed corn is exhauſted. Whether it rots, or not, ſeems to be of little conſequence to the plant, which no longer draws its ſubſiſtence from the ſeed. If the plant becomes mouldy, it may either die, or be ſtinted: but how this mouldineſs ſhould affect only the organs of fructification, ſo as entirely to deſtroy them, without doing any ſenſible injury to the reſt of the plant, is not eaſily accounted for. To ſhew that the fact may be ſo, M. Aimen inſtances a wild-pink, which, for three years, produced none but ſmutty ſeed, though the root was perfectly ſound. If we ſuppoſe that the growth of plants is only an enlargement of what was in miniature in the ſeed, we may conceive that the bloſſom alone may be affected. But let us keep to facts, which we ſhall always find of much more importance than mere conjectures, too often unſupported by any great probability of truth.

M. Aimen agrees in opinion with thoſe who think that, the powder of ſmutty grain will render ſound corn ſmutty, if ſtrewed upon it: but he does not think that the only cauſe; for it may happen that a year, in which there is a great deal of ſmutty corn, may be ſucceeded by another in which there is ſcarce any: or perhaps a year quite free from ſmut, may be followed by a year no leſs remarkable for great abundance of ſmut. This infection cannot be the cauſe that wheat gathered off the ſame ground, taken out of the ſame ſheaf, and ſowed without being prepared with any ſteeps, ſhall in ſome fields produce ſound wheat, and in others ſmutty.

This obſervation, and a perſuaſion that other cauſes may contribute to bring this diſorder, as effectually as the ſmutty powder does, induced M. Aimen to try many experiments, from which he draws the following concluſions.

1. That the beſt ripen'd and ſoundeſt grains ſhould be choſen for ſeed.

2. That the black powder certainly diſpoſes corn to become ſmutty.

3. That the ſmut is to be feared as often as the ſeed time is rainy. This may be avoided by beginning to ſow early.

4. Whatever weakens the plant, brings the ſmut; for ſeed-corn which has been pricked or run through with a needle, or which is

not fully ripe, and that which produces lateral or ſecond ears, is ſubject to the ſmut. As a proof that whatever weakens plants, cauſes the ſmut, he obſerves, that it is a frequent cuſtom with them to cut rye as ſoon as it ſpindles, for food for their cattle; and that this rye generally produces other ears, which ſeldom contain any but diſtemper'd grain.

Mr. Tull tells us that the cure of this diſtemper was firſt found out by an accident, which he relates thus.

" Brining of wheat, to cure or prevent ſmuttineſs (as I have been " credibly informed) was accidentally diſcovered about ſeventy years " ago, in the following manner, *viz.* A ſhip-load of wheat was " ſunk near Briſtol, in autumn, and afterwards at ebbs all taken up, " after it had been ſoaked in ſea-water: but it being unfit for making " bread, a farmer ſowed ſome of it in a field; and when it was " found to grow very well, the whole cargo was bought at a low " price by many farmers, and all of it ſown in different places. At " the following harveſt, all the wheat in England happened to be " ſmutty; except the produce of this brined ſeed, and that was all " clean from ſmuttineſs."

We ſhall here copy the directions given by the author of the *New Syſtem of Agriculture* for the choice and preparation of ſeed corn.

" Let your corn be brought into the corner of a large barn floor, or great boarded hall, ſuch as few country houſes are without: order a man, with a broad wooden ſhovel, to throw the corn, with all his force, towards the oppoſite corner of the barn, or hall: the laſt is generally the fitteſt for it. In this exerciſe, all light, ſmall, ſhrivell'd grain, and the ſeeds of cockle, darnel, and other weeds, not being ſo heavy as the ſolid corn, will fall ſhort, and lie neareſt to the man who throws them; while ſuch as are large, plump, and weighty, out-flying all the reſt, are ſeparated widely, and may eaſily be gathered in what quantity you pleaſe. Experience only is capable of making men believe the wonderful advantages of ſowing ſeed thus choſen.

" Take your corn, when it has been thus obtained, and throw it, by a buſhel at a time, into a large veſſel full of water: let a man ſtir it with a ſtaff, as violently as he can, for a conſiderable while together, and then, giving it a little time to ſettle, ſkim off all that ſwims upon the ſurface; and repeat this labour till no more riſes: after which, take out the corn which is ſunk to the bottom, and lay it by for ſeed; proceeding in the ſame manner, till you have your intended quantity.

" Now make a *brine*, by throwing *bay-ſalt* into *rain-water*, till it becomes of ſtrength enough to bear an egg. In this liquor ſteep your *ſeed corn* for thirty hours: leſs time will have no manner of effect. Obſerve this, and regard not the contrary opinions of any men, let them pretend to never ſo much ſkill.

" When you take your corn out of this brine, ſpread it upon a ſmooth floor, and, ſcattering upon it good ſtore of the *fine-ground powder of ſlack'd lime*, ſweep it up and down, and mingle it with the corn, till every grain leaves clinging to another, and becomes, as it were, *candied* with the lime: and in this condition let it be ſowed, never entertaining a moment's doubt of the infallible increaſe of your harveſt."

Several farmers vary this ſteep, by adding to it a mixture of pigeons or other dung.

In moſt of the provinces of France, they make no uſe of ſalt; doubtleſs becauſe it is too dear: but they ſteep the wheat in lime-water. For this purpoſe, they put it into baſkets, and carefully ſkim off all that ſwims on the top, moſt of which would not ſprout, and is only fit to feed fowls.

Other farmers pretend that the ſureſt way to be free from ſmut, is, to change the ſeed every year; and that the ſeed which comes off a ſtrong ſoil, is the beſt. A farmer in whom Mr. Tull had great confidence, told him, that, for ſeveral years, he had his ſeed corn from another farmer, who alſo changed his ſeed every year, and that he was free from ſmut, though the neighbouring farms were always infected with it: but above all, he aſſures us, that the drill huſbandry is the moſt effectual cure.

M. Aimen, after giving an account of the ſeat and cauſes of this diſtemper, enumerates the remedies recommended by authors: lyes of lime, ſalt-petre, allum, verdigreas, vitriol, common ſalt, and the aſhes of plants, are recommended by Mr. Pluche.

A mixture of water and urine, or a decoction of cypreſs leaves, are recommended as ſpecifics by Columella and Pliny. The farmers boaſt much of the juice of houſe-leek and other cold plants; and Virgil recommends lees of oil.

As weak plants are moſt ſubject to ſmut, M. Aimen recommends good tillage, as a ſure means of giving them ſtrength and vigour. 'Tis

'Tis probably for this reaſon that corn is very ſeldom ſmutty when managed according to the new huſbandry.

He obſerves that all the lyes generally made uſe of, preſerve the plants from mouldineſs: and of all of them, lime ſeems to him the moſt effectual.

On the whole, he adviſes that the beſt wheat be choſen for ſeed; that it be reaped in fair weather; that it be threſhed out immediately, and that it be ſprinkled with lime the next day after it is threſhed. He adds, that every method he has tried to make corn ſo prepared grow mouldy, has been ineffectual, and that he has never known it produce ſmutty ears.

M. de St. Meſmin de Lignerolle ſays, that the ſureſt means of avoiding ſmut, and which he has practiſed with ſucceſs ever ſince the year 1739, on near 300 arpents of land, is, to change the ſeed every year, to be very careful that the ſeed corn be well dried and thoroughly ripe, and that it be not ſmutty, nor have any ſmutty powder ſticking to it. He then pours boiling water on quick-lime, in a large tub; and after the ebullition is over, as much cold water as there was hot, and ſtirs it all ſtrongly together, in order to diſſolve and thoroughly mix the lime. The quantity of wheat intended to be ſowed, is ſprinkled with this lye, and then well ſtirred with a ſhovel, and laid in as high a heap as poſſible. It is beſt to keep the grain for a week after this preparation, turning it every day; for otherwiſe it would heat ſo as to deſtroy the germ. By theſe means, M. de St. Meſmin has had no ſmutty wheat, tho' all around him is very liable to that diſtemper.

M. Donat, near Rochelle, writes, that, thinking the ingredients generally employed in ſteeps, too dear for the uſe of farmers, he had ſtudied for ſome years to find out ſomething cheaper, which might be eaſily had in every province of the kingdom, and would therefore be of general uſe, not only to France, but to all Europe. I have had, ſays he, the good fortune to accompliſh what I wiſhed; for I now uſe only pigeon's dung, quick-lime, aſhes, or ſea-ſalt, where it can be conveniently had. I have ſometimes made with theſe ingredients, ſteeped in water, ſo ſtrong a liquor, that it has even deſtroyed the germ of the grain. But there will be no danger of that, if the following directions are obſerved, which are the reſult of ſeven years ſucceſsful experience, even at times when farmers who have neglected to follow my example, have had ſuch wretched crops as have not paid the charge of reaping.

The following receipt will be found of great ſervice to preſerve corn from ſmut.

Take quick-lime and pigeons dung, of each twenty-five pounds; forty pounds of wood-aſhes, and twenty-five pounds of ſea-ſalt, or ſalt-petre. Put all theſe into a tub large enough to hold half a hogſhead of common water added to them. Stir them all well, with a ſtick, till the lime is quite diſſolved. This lye will keep ſome time without ſpoiling.

When the corn is to be ſteeped in the lye, it muſt firſt be ſtirred. The grain is then put into a baſket, and plunged into the lye, where it remains till it has thoroughly imbibed it; after which, it is taken out, and laid in a heap, till it is drained of all its moiſture. Or, which is ſtill better, take a maſhing-tub, fill it with grain to within four inches of the brim, and then pour in the lye well ſtirred beforehand. When the tub is full, let the lye run out at the bottom, into ſome other veſſel, in order to uſe it again for more corn. Let the grain be then taken out and laid in a heap to drain; and continue in this manner to ſteep all your ſeed corn. The wheat thus prepared, may be ſowed the next day, and muſt not be kept above five or ſix days, for fear of its heating. This I ſay from experience. The quantity of lye above preſcribed, will ſerve to prepare twelve or thirteen hundred weight of wheat.

Le Charbon.

THE French ſeem to give it this name, from the grain's appearing as if burnt. We ſhall therefore tranſlate it *burnt-grain*. Mr. Liſle calls it *uſtilago*, or *burnt-ear*.

The ears attacked with this diſtemper, are not, at firſt, readily diſtinguiſhed from the ſound: but after they have paſt blooming, they become of a brown-green, and afterwards turn whitiſh, by which they are then eaſily known. The burnt grain is ſometimes larger, and at other times leſs than ſound grain. It ſwims on water. This diſtemper affects only the grain. The ears remain in a ſound ſtate: only they are white, and drier than ſound ears.

Though all the ears which proceed from the ſame plant are uſually attacked with this diſtemper, yet we now and then find ſound ears on the ſame plant with the infected: nay, we have ſometimes ſeen the grains of one half of an ear ſound, whilſt thoſe of the other half were burnt; and at other times only a few ſound grains in a diſtemper'd per'd ear. We have likewiſe ſeen, though very ſeldom, one part of a grain ſound, when the other part was burnt. M. Aimen has frequently cut all the ears off a flouriſhing plant, and others have grown in their ſtead; but the grain was burnt. This, ſays he, accounts for our ſo frequently meeting with burnt grain in fields, where ſome of the ears have been broken down by hail, in May.

When a burnt grain is crumbled, as it generally may, with eaſe, betwixt one's fingers, the inſide is of a dark brown colour, and the ſubſtance contained within it, ſtill retains ſome degree of firmneſs.

We have ſaid, that ſmutty grains being often carried off by wind, or waſhed away by rain, do no great damage to the ſound grain. It is not ſo with the burnt grains; for many of them are ſometimes ſo firm, as not to be cruſhed to pieces by the flail, ſhovel, or ſieve; but one of them ground to powder in the mill, is ſufficient to alter the colour of a conſiderable quantity of flour.

The burnt grains have a bad ſmell, and retain a good deal of moiſture: two qualities which render them very unfit for keeping.

As the burnt grains are lighter than the ſound, many of them are ſeparated by throwing the corn to a diſtance with a ſhovel, or by winnowing, or ſifting it in the wind: but it is very difficult to get quite clear of them. When they are broken, they infect the ſound grains, and ſtick to them, as we obſerved of the ſmut. The French farmers give the ſame name to both the diſtempers we have been ſpeaking of, ſaying that the corn is *moucheté*, *ſpotted*, or *colour'd at the end*. This laſt is eaſily rubbed off with a cloth, and is likewiſe loſt by long keeping after the corn has been frequently ſifted, eſpecially in cylindric ſieves. Some farmers waſh it off in fair water; which ſhould always be done before ſuch corn is put into any ſteep.

M. Tillet's memoir relates chiefly to this diſtemper. We ſhall paſs over his accurate and curious experiments, and, as before, give only the reſult of his inquiries.

He found, 1ſt. that no kind of dung had any ſenſible effect in producing burnt grain or ſmut. The infected ſeed produced as much burnt grain in places not dunged, as in others that were. No kind of dung quickened or retarded the progreſs of this diſtemper.

Sound

Sound feed-corn produced no more burnt grain in places that were dunged, than in thofe that were not dunged.

2. The ftraw of diftemper'd corn, putrified, did not produce burnt grain: but fuch ftraw, not putrified, feem'd to produce it. The fame may be faid of the powder of burnt grain, when mixed with the earth.

3. In every trial of fowing corn *fpotted* or *coloured at the end*, whether gather'd on the fpot, or brought from a diftance, the diftemper prevailed to that degree, that fometimes three-fifths of the ears were bad.

4. Chofen wheat, taken grain by grain out of pick'd ears, in order to be certain that there were no diftemper'd grains among it, being fowed, fome in dung'd and fome in undung'd land, fome with and fome without preparation, produced little or no burnt grain. The fame chofen feed, fprinkled with the powder of diftemper'd grain, produced as many diftemper'd ears, as grain originally infected with it. This powder does not lofe its contagious quality in a great degree of heat, nor indeed unlefs it be quite burnt. It keeps it for years as ftrongly as at firft.

5. This chofen feed fteep'd in a lye with quick-lime and fea-falt, gave fewer diftemper'd ears, than when fown without being fteep'd. It produced ftill lefs of them when falt-petre was ufed inftead of fea-falt.

6. The circumftance of fowing late or early, feem'd of little confequence.

Many farmers think it a very neceffary precaution to wafh the facks into which they put their feed corn, becaufe they think that even the fmell may infect the found feed. M. Tillet thinks that if the fower has any of the powder on his hand, it will infect part of the corn he fows.

The fame gentleman thinks he has remarked, that diftemper'd plants of wheat are more eafily affected by froft, than found ones. If fo, ftrong frofts are of great fervice, becaufe, at the fame time that they deftroy thofe diftemper'd plants, they render the earth better able to afford fufficient nourifhment to the found ones.

By M. Tillet's experiments, the contagious powder of wheat does not affect rye, or four row'd barley or bigg: but the powder of cockle or darnel is pernicious to wheat.

M. Tillet tried many experiments to difcover the moft effectual cures

cures for this diſtemper; from which he draws the following concluſions.

1. The effect of the black powder is only ſuperficial, and does not affect the internal parts of the grain before it is ſown in the earth.

2. Whatever therefore removes this powder from off the outer ſurface, will greatly conduce to preſerve corn from this diſtemper.

3. Grain perfectly free from all infection of this powder, will not produce diſtemper'd grain.

4. Grain blackened with this contagious powder, may be render'd ſound, by clearing it entirely of the powder.

5. The action of ſifting, and the precaution of waſhing the grain in ſeveral waters, leſſen the effects of the contagion: but they are not ſufficient to cure it; for we have found ſeveral ears with burnt grain, tho' the ſeed had been waſhed in ſeveral waters.

6. Lime, tho' of greater efficacy than plain water, is not alone ſufficient. It may be remarked here, that the manner of liming corn, was formerly different from what is practiſed now. They then put the grain into baſkets, which they plunged into warm lime-water. They ſtirred it ſtrongly in the baſkets, and carefully ſkimm'd off all that ſwam on the top. By this means, they got rid of all the diſtemper'd grain. This was much better than ſimply pouring lime-water on a heap of grain, as is the practice now-a-days, and then turning it with ſhovels; or mixing with the grain lime ſlack'd in the air, and reduced to powder.

7. Waſhing the grain touched with the powder, in ſeveral waters, is a very good precaution: but it muſt be afterwards ſteep'd in brine till it is thoroughly penetrated therewith, and then have powder of lime ſtrewed upon it.

8. A ſtrong brine of ſea-ſalt is good, and may be uſed to great advantage where ſalt is cheap.

9. Salt-peter is better than ſea-ſalt, and ſhould be made uſe of where much nitrous earth abounds.

10. Strong alkaline lyes are ſtill better. Pot-aſh, ſalt of tartar, a lye made of any vegetable aſhes abounding in ſalt, urine of men or cattle, become alkaline by putrefaction, &c. Of theſe, the eaſieſt come at in every place, may be choſen to make a lye for ſeed corn. Near the ſea, they make uſe of the aſhes of ſea-weeds. Theſe aſhes, rejected by dyers and others who uſe lyes, becauſe they have too much

much sea-salt in them, may, for that very reason, be employed to greater advantage for seed corn.

As men generally love to raise objections, some may perhaps say, that if this distemper is so contagious as has been here represented, it would make such progress from year to year, that at last we should reap nothing, but burnt grain: but this is not the case; for frequently a year in which this distemper prevails much, is succeeded by a year in which scarce any of it is seen. Such was the year 1754.

M. Tillet's observations are an answer to this objection: for hard frosts kill so many of the distempered plants, that its progress is happily stopt.

It may be again asked, if the contagious powder is the only cause, how comes there to be burnt grain in a province where it never was before? It may be answered, that other causes may produce it; particularly, as Mr. Aimen observes, whatever prevents the grains being impregnated while in blossom.

M. Delu boiled two pounds of salt of tartar in a quantity of water sufficient to steep an hundred pound weight of wheat, which he put into it while the lye was warm, and afterwards sprinkled it with quick-lime.

This grain was sowed the 11th of October 1755, in part of a field of three arpents. The rest of the field was sowed with some of the same wheat, only steeped in lime-water. No difference appeared in the plants of these grains, during their growth; but some days before they were reaped, M. Delu, with an experienced farmer, examined them very carefully, and found a good deal of burnt grain in the part sowed with the wheat which had been steeped in the lime water; but much less in the other part where the grain steeped in the lye was sowed. This confirms M. Tillet's experiments.

Of the distemper in rye, called ERGOT.

AS I know no word in our language answering to what is meant here by the French word *ergot*, I must retain it.

According to Mr. Aimen, the *ergot* in rye is the same distemper as the *charbon* in wheat. If there be any difference, it is owing to the different organization of the two grains.

1. The distempered grains of rye are larger and longer than the

 sound,

ſound, and come out of the chaff, appearing ſometimes ſtrait, and at other times more or leſs crooked.

2. Externally, they are dark coloured or black: their ſurface is rough, and frequently three furrows may be perceived in them, which run from end to end. Their outward end is always larger than that which adheres to the chaff. That larger end is ſometimes ſplit into two or three parts. It is not unuſual to perceive ſome cavities on their ſurfaces, which look as if made by inſects.

3. When the diſtempered grain is broke, there is in the middle or centre of it a whitiſh flour, which is covered with another kind of flour of a rediſh or dark colour. This diſtempered flour falls to pieces between the fingers. M. Aimen has ſometimes found it almoſt as black as the powder of ſmutty wheat.

4. Theſe grains being put into water, ſwim at firſt, and afterwards fall to the bottom. If chewed, they leave a bitter reliſh on the tongue.

5. The chaff appears ſound, though what is outmoſt is of a darker colour than when the grain is ſound.

6. All the grains in an ear are never diſtempered at once. They ſtick leſs to the huſks, than ſound grains do.

7. M. Aimen imputes this diſtemper to the grain's not being impregnated; and therefore what is ſaid of the *charbon* in wheat, may be applied to the *ergot* in rye.

Both M. Tillet and M. Aimen are of opinion that other plants, beſides rye, are ſubject to this *ergot*. M. Tillet aſſerts that he has found ſome grains of wheat attacked with this diſtemper. If ſo, they are two different diſtempers, not to be confounded together. What ſeems ſtill more to eſtabliſh this difference is, that, by M. Tillet's experiments, the diſtempered ſubſtance of the rye is not contagious.

M. Tillet ſeems to think that the *ergot* is occaſioned by the ſting or bite of ſome inſect, which turns the rye into a kind of gall.

Several phyſical writers give many inſtances of people who have been ſeized with diſeaſes, by eating, for their conſtant food, in ſome years, bread in which there was much of this diſtempered rye.

As the diſtempered grains are larger than the ſound ones, it is eaſy to ſeparate the greateſt part of them by ſifting. It is what the country people do, when corn is not dear: but in times of great ſcarcity or dearth, they are loth to loſe ſo much grain. It is then that they are apt to be attacked with a dry gangrene, which mortifies the extreme

treme parts of the body, ſo that they fall off, almoſt without cauſing any pain, and without any hemorrhagy. The Hotel-Dieu at Orleans has had many of theſe miſerable objects, who had ſcarce any thing more remaining than the bare trunk of the body, and yet lived in that condition ſeveral days.

As it is not every year that the diſtempered rye produces theſe dreadful accidents, Langius is of opinion that there may be two kinds of this diſeaſed rye; one which is not hurtful, and another which occaſions the gangrene. It is however probable, that there is but one kind, and that it does no hurt, firſt, when ſufficient care is taken in ſifting the grain; and, ſecondly, when only a ſmall part of the rye is diſtempered. It is alſo ſaid, that the rye loſes its bad quality by keeping: in which caſe, the reaſon why the peaſants are attacked with the gangrene in years of dearth, may be, becauſe they conſume their crop as ſoon as the harveſt is over.

CHAP. XVII.

Of S T E E P S.

STEEPS were brought very early into uſe in huſbandry; not only as preſervatives againſt the ſeveral diſtempers of corn which we have been ſpeaking of, in which they are demonſtratively of great uſe; but alſo with a view to render the ſeed more fruitful. The Romans, as has been already obſerved, had their lees of oil, decoction of cypreſs leaves, juice of houſe-leek, &c. Lord Bacon was the firſt who ſeems to have beſtowed any attention on this ſubject in England. What he did, was rather pointing out the path to others, than determining any thing poſitive on this head himſelf. I do not know any author who has yet given us a ſet of experiments with this view, which have been long enough continued to determine what effects any ſteeps have towards rendering grain more fruitful.

Van Helmont, and ſince him the authors of the *maiſons ruſtiques*, have given many receipts for ſteeps, which they boaſt greatly of, as increaſing the fruitfulneſs of the ſeed that is ſteeped in them. Thoſe who recommend theſe receipts, adviſe ſowing the corn thinner than uſual; generally one third leſs.—All the experiments in this work will ſhew evidently, that this one circumſtance of ſowing thin, will add greatly to the crop. That the compariſon may be juſt, all cir-

circumſtances ſhould be alike, as to the goodneſs of the ſoil, the quantity and quality of the ſeed, &c.

To ſatisfy myſelf whether or no any benefit does ariſe from the uſe of ſteeps, by way of giving the ſeed a greater degree of fruitfulneſs, I tried the following experiment. I infuſed ſome good wheat in a lye of dung, mixed with lixivial ſalts, nitre, and ſal ammoniac. I ſowed with this grain two beds in my kitchen garden, dug with a ſpade. One of the beds was ſowed very thick, and the other very thin. At the ſame time I ſowed two other beds, exactly like the former, with ſome of the ſame ſeed, not ſteeped, one thick, and the other thin. At harveſt time, the beds ſowed with the ſteeped ſeed, were ſo exactly like the others, that it was impoſſible for the eye to diſtinguiſh between them.

A gentleman in my neighbourhood followed exactly the directions given in the *maiſons ruſtiques*, in the uſe of one of their boaſted receipts, which is there ſaid to be of ſuch efficacy, that the land need be plowed but once for wheat prepared with it. He did ſo; and his crop was ſcarce worth reaping.

Mr. Peyrol, many years ſecretary to the intendant of Auvergne, acquaints me, that he had made ſeveral experiments in imitation of thoſe mentioned in the Abbé de Vallemont's book. In the month of May 1755, he planted in his garden, which is a hot indifferent ſoil, four ſmall cabbages, which had only four leaves. In September following, the ſame cabbages were ſix feet and a half in circumference. Some plants of red wheat, tranſplanted into a bed dug very fine in his garden, bore 130 ears a piece, which contained each of them from 40 to 80 grains. Some plants of white wheat, tranſplanted at the ſame time, produced 120 ears, each of which had from 30 to 40 grains. Two grains of red wheat, ſowed in the ſame bed, and not tranſplanted, produced each of them 140 ears, which contained 6000 grains.

Five plants of red wheat, diſtant from one another ſix inches, did not branch ſo well, being too cloſe together: but each of them produced from 40 to 50 ears, which contained from 40 to 60 grains.

Rye, which branches leſs than wheat, produced from 30 to 35 ears, each containing from 60 to 70 grains.

The barley of that country, which branches little, has however produced from 60 to 80 ſtalks, tho' the ſeed was not ſteeped in any liquor before it was ſowed.——The author of theſe experiments

 judiciouſly

judiciously observes, that they must be repeated and varied, to make it appear that the great increase is owing to the steep.

This liquor of the Abbé de Vallemont is as follows.

Put into a tub, exposed to the south, one bushel of horse-dung, the same quantity of cow-dung, half a bushel of pigeon's dung, as much sheep's dung, as much ashes, three gallons of small prick'd wine, two pounds of salt-petre, and as much water as will sufficiently dilute the whole, so as to make it thin enough for use.

Every time that any of this liquor is taken out to sprinkle the plants, it is filled up again with water; and as it may be too strong at first, it may be weakened accordingly.

M. Peyrol added to this infusion, frequent digging; for the ground was dug five times between the plants of wheat: and he observed that each digging sensibly gave fresh vigour to the plants, and that the stalks, which were six feet high, were not laid.

M. Donat says, he has made trials of these mixtures, from the use of which so much is promised: but he acknowledges that he thinks them of no other service, than to amuse the curious, who do not regret expence. As they boast that all kinds of soils, whether good, bad, or indifferent, whether well or ill plowed, whether rested or not rested, will produce ten times more than in the common way, M. Donat sowed a large extent of ground, some good, some bad, some well, and some ill plowed, &c. He made the lye himself, was present when the seed was sowed, and took care that no circumstance was neglected. But notwithstanding all his care, his crop was far from answering their promises.

The good, well-cultivated soil, produced fine wheat; but not extraordinary in point of quantity. The only advantage was in the saving of the seed.

The poor ill cultivated land, and that which had not been rested, produced very little grain: and the very bad soil, nothing at all. These experiments convinced M. Donat, that the surest means of obtaining good crops, is, to have the ground in good condition. This is the principle on which the new husbandry is founded. It offers nothing marvellous, or contrary to the most ancient precepts of good husbandry.

These experiments of M. Donat's seem sufficient to prove the inefficacy of these pretended secrets. However, experiments of this kind should be continued on a double account; first, to take off a prejudice

prejudice which ſeems to gain ground, though it be not founded on any rational principle; and next, to be well aſſured whether theſe preparations do produce any ſenſible effect. Experiments ſeldom prove uſeleſs to careful accurate obſervers. If they do not always anſwer the end propoſed, at leaſt they ſometimes lead the way to other important diſcoveries.

CHAP. XVIII.

Of WEEDS.

PLANTS that grow in any ground, different from thoſe which are intended to be cultivated in it, are called *weeds.*

They exhauſt the earth, as much as the moſt uſeful plants: nay, they ſometimes get the aſcendant, and multiply to ſo great a degree, that a field will almoſt ſeem never to have been ſowed with corn.

The weeds which are feared moſt, are, 1. *Cockle* or *darnel.* Its ſeed is black; but being heavy, and nearly of the ſame ſize as the grains of wheat, it is not eaſily ſeparated from them. Sifting, and throwing the corn at a diſtance on a large floor, are the beſt ways of clearing the wheat of it. If ground with the corn, it makes bread look black.

2. *Fox-tail,* the ſeed of which is ſomewhat like wheat. This gives bread a bitter taſte.

3. *Wild poppy,* or *red-weed,* the ſeed of which is very ſmall, and ſometimes multiplies ſo prodigiouſly that it choaks the wheat.

4. *Wild fitch,* which covers the corn when it is laid, hinders it from riſing again, and makes it rot.

5. *Dog's graſs,* and *colt's foot,* which multiply by their ſeeds, and extend themſelves by their creeping roots, and even by the pieces of their roots which are broke off by the plough.

6. *Melilot,* which gives bread a bad taſte; and

7. *Thiſtles,* and many other weeds which greatly exhauſt the earth.

8. *Charlock,* the young plants of which it will be of advantage to the farmer to be able to diſtinguiſh from young turneps, eſpecially in weeding the latter, leſt they be reared or plucked up indiſcriminately. This can ſcarcely be done but by the taſte, the charlock being hot and bitter, and the turnep mild.

To prevent the increaſe of weeds, it is proper to deſtroy them before

before their ſeed is ripe. But that is not poſſible in lands which are plowed in the common way; becauſe they grow with the good corn, and moſt of them ripening ſooner than the wheat, their ſeeds ſow themſelves, and the weeds multiply. Neither muſt we expect to deſtroy them by reſting the land; for their ſeeds will remain ſound ſeveral years in the earth. If a field that has a great many poppies in it, is ſowed with ſainfoin, ſcarce a poppy will appear the ſecond year: but when the ſainfoin is plowed up at the end of even nine years, the poppy frequently appears anew; which can hardly be owing to any other cauſe, than that its ſeeds have remained ſound in the earth all that time; for very few of them can have been brought from the neighbouring grounds, or in dung.

An experiment which I made, confirms this. I ordered the earth with which a ditch had been filled fifteen or twenty years before, to be dug out, and ſpread on a piece of plowed land. Several plants, of different kinds from any that were in the reſt of the field, ſprouted up in the place where this earth was laid. Conſequently they were produced by ſeeds which had remained ſound in the earth, during the fifteen or twenty years that the earth had laid in the ditch.

It is partly for this reaſon, that lands which are fallowed, are plowed thoroughly; and it is certain, that as numbers of ſeeds ſhoot up during the fallow, repeated plowings deſtroy many of them. But there are ſeveral kinds of plants, ſuch as wild oats and fox-tail, the ſeeds of which do not ſprout, till they have remained two or three years in the earth; nor will culture make them grow ſooner.

Some experiments have been made, which ſeem to contradict our author here. From them it ſeems to appear that the ſeeds of thoſe plants which he ſays require to remain three years in the ground, were only buried ſo deep that they remained ſound for many years, and that they will not ſprout till they happen to be laid at ſuch a depth as is convenient or fit for their ſprouting. Though the increaſe of weeds may be prevented for ſeveral years, by plowing, cutting, pulling them up, &c. Yet ſome of their ſeeds may be thus brought up by each plowing, till all of them have ſprouted, and then the field may be kept quite clear, by care.

It is evident that the repeated plowings of fallow lands, far from deſtroying theſe kinds of weeds, ſerve perhaps only to help their ſeeds to grow more certainly, when the time of their ſprouting is come.

Far-

Farmers have not yet thought of a more effectual method to deſtroy weeds, than by ſowing the ground out of ſeaſon; that is to ſay, by ſowing oats the year that wheat ſhould be ſowed. It has been experienced, that, by this means, ſome kinds of weeds have been deſtroyed, which, appearing only every third year, never ſhew themſelves but amongſt wheat.

But the farmer loſes a crop, and has ſtill a great number of weeds to deſtroy; which obliges him to weed his corn. This is done two different ways.

A number of women place themſelves in a row; and holding in their hands a hoe properly made, they cut all the weeds they ſee, ſuch as thiſtles, blue bottles, poppies, *&c.* If theſe weeds are very young, they frequently eſcape the eye of the weeder; and in that caſe the hoeing muſt be repeated when they grow bigger.

But the ſmaller weeds, which are at leaſt as hurtful, ſuch as wild-fitch, wild-oats, cockle or darnel, knot-graſs, fox-tail, and all young poppies, remain in the field.

Beſides, in cutting the weeds, it is ſcarce poſſible not to cut down the corn; and the roots of the thiſtles and other biennial plants which are cut, produce two or three new ſtalks inſtead of the old one; by which means the evil is increaſed.

The other method of clearing corn, is, hand-weeding it. This is ſeldom practiſed by farmers, becauſe it is too expenſive. In vineyards indeed, women who have cows to feed, are glad to have leave to pluck up the weeds for them. But in pulling up thoſe weeds, they likewiſe pull up a great deal of corn, and, what with that, and with their trampling, and dragging their bags of weeds over it, they do more hurt than good; eſpecially if the earth is moiſt.

The ſureſt way to deſtroy weeds, is, to continue plowing whilſt the corn grows: but this can be done only in the new huſbandry.

Weeds may be diſtinguiſhed into four kinds: 1. Into ſuch as have creeping perennial roots. 2. Such as grow in cold wet ſoils. 3. Such as are of a large ſucculent body; and 4. Such as having ſmall ſeeds, or that ripening before the corn, ſow themſelves. Each of theſe require different methods, to deſtroy them.

The firſt can only be deſtroyed by repeated ſummer fallows, by which their roots are cut, and turned up to be withered by the ſun and winds; after which they are dragged out by harrows, and ſhould be burnt. This repeated as often as the farmer can conveniently during a dry ſeaſon, or repeated another ſeaſon, can ſcarcely fail to complete the cure. *Colt's foot*, which is propagated by the root, may likewiſe be deſtroyed by ſowing the ground with rye-graſs, or any plant which, coming up early in the ſpring, ſhadows and ſmothers it, whereby it dies in a few years.

The ſecond are deſtroyed by draining the earth of its ſuperfluous moiſture, and by warming it with lime, aſhes, gravel, ſhelly ſea-ſand, *&c.*

The third are deſtroyed by cutting them down when in full ſap and vigour: for the ſudden interruption which this gives to the motion of the ſap, cauſes it to ſtagnate in the roots, and putrify there. Some few and weak lateral ſhoots may be made; but they too being cut in the ſame manner, the roots are entirely putrified by degrees, and, inſtead of annoying, become a manure.

The fourth can be deſtroyed only by frequent fallows, and conſtantly cutting, or rather plowing them down before they run to ſeed. Some, for inſtance the wild oats, may be mowed for hay, but it is much more beneficial to the land to have them turned down; for by that means, inſtead of being exhauſted by frequent crops, it is manured by thoſe enemies to uſeful grain.

Banks and hedges ſhould be preſerved free from weeds; not only to preſerve their bottoms thicker, but alſo to prevent the ſeeds of weeds from being carried into the adjacent fields, by winds, by which means the corn muſt be conſtantly peſtered with them.

A PRAC-

A
PRACTICAL TREATISE
OF
HUSBANDRY.

PART II.

EXPERIMENTS *and* REFLECTIONS *relative to the* NEW HUSBANDRY.

CHAP. I.

Experiments on Wheat.

SECT. I.

Experiments made at Denainvilliers *and* Acou, *in the Year* 1750.

MR. Duhamel begins his account of the advantages of the new husbandry, with experiments made on small pieces of land. The two first which he mentions were made with great care, one under his own eyes at his brother's estate called Denainvilliers, and the other under the eyes of his neighbour, M. de St. Hilaire.

The more easily to compare the produce of the new husbandry with that of the old, says he, I shall here take the extent of two arpents; each containing an hundred perches, and the perch twenty-two feet.

The two arpents lay in the ſame field, and were plowed as uſual for wheat. They were divided into two equal parts, by a furrow, ſo that the quality of the ſoil in each was perfectly alike.

One of theſe arpents was ſowed in the common way with 10 buſhels of dry grain, weighing 210 pounds, which, after being ſteeped, and ſprinkled with lime, filled 12 buſhels, and weighed 52 pounds.

The other arpent was ſowed with the drill plough, in the following manner: firſt, a border of two feet was left unſowed; then three rows of wheat were ſowed in a bed two feet wide: after which another ſpace four feet wide was left unſowed. This ſpace we call the *alley*. The beds, of three rows of wheat each, and the alleys, were thus continued alternately till the whole was finiſhed.

As the grains of wheat were ſowed in the rows at the diſtance of four, five, or ſix inches from each other, two buſhels, or forty two pounds of wheat ſteeped and limed, were more than ſufficient to ſow this arpent; by which a ſaving was already made of ten buſhels or two hundred and forty pounds of wheat, which would have been uſed in the common huſbandry.

This arpent was ſowed ſo thin, that during the winter and the beginning of the ſpring it had more the appearance of ground only plowed, than of a field which had been ſowed; whereas the other was green as a meadow.

In the ſpring, we viſited the rows, and pulled up the plants where they grew too thick, ſo as to leave at leaſt four inches diſtance between each. The alleys were firſt ſtirred with the horſe-hoe.

The horſe-hoeing had a wonderful effect: the wheat became of a deep green, puſhed forth large blades, and branched greatly; ſo that by the middle of May the earth between the rows was quite covered, and the wheat was higher than that of the other arpent, which, in compariſon of this, was of a yellowiſh green. When the wheat of the rows began to ſpindle, it was almoſt as high again as the other. The alleys then received their ſecond hoeing.

We plucked up at this time ſome of the moſt thriving plants of the wheat ſowed in the common way, and found that each grain had produced no more than two, three, and very rarely four ſtalks capable of yielding ears. Many grains had even produced but one ſtalk, of which, numbers were very weak, and ſeemed choaked by the reſt.

Each grain of wheat in the rows, on the contrary produced eight, twelve,

twelve, fifteen or twenty ſtalks, almoſt all of them ſtrong and able to produce large ears.

The wheat in the common way was in full ear, before one appeared in the rows, in which nevertheleſs the wheat was taller, and ſtill of a deep green.

As ſoon as the wheat of the rows was in ear, it was horſe-hoed a third time, and continued growing taller as the ears appeared. It bloſſomed, and the grain formed extremely well: but it was ſtill very green when great heats came on, which ripened it ſuddenly, and prevented its farther increaſe, which would otherwiſe have been conſiderable.

The crop would certainly have been more plentiful, had it not been for this untimely heat: yet, contrary to our expectation, the grain was not parched; but proved larger and better filled than that of the other arpent.

The wheat was ſowed at Acou, as at Denainvilliers: the hoeings were repeated in the ſame manner; the progreſs of the wheat ſowed in both ways was alike; and laſtly, the great heats accelerated too much the ripening of the wheat in the rows, at Acou, as at Denainvilliers.

Reſult of the Experiment at Denainvilliers.

The arpent which was plowed and ſowed in the common way, had been very well dunged; and the other, which was cultivated according to the new huſbandry, had received no dung at all. This ſhould make ſome difference in their products. Let us compare them.

The arpent which was cultivated according to the new huſbandry produced 284 ſheaves: the other 476. It is proper to obſerve that the quantity of fodder was not in proportion to the number of ſheaves; becauſe the ſtraw which grew in the rows was much longer than that of the other arpent.

The arpent ſowed in rows, yielded 70 buſhels of large wheat, weighing 1470 pounds.

The other yielded 98 buſhels of ſmaller wheat, which weighed 2058 pounds.

Thus the field which was cultivated in the common way produced 28 buſhels or 588 pounds more than the rows. But it muſt be remembered, that only two buſhels or 42 pounds of wheat were employed to ſow the rows; whereas 12 buſhels or 252 pounds were uſed to ſow the other arpent. Ten buſhels, or 240 pounds, ſhould therefore be deducted from the produce of this laſt, which will then exceed that of the rows only by eighteen buſhels, or 372 pounds.

The expence of dunging an arpent, is equal to the value of twenty buſhels of wheat when it bears a middling price. This already brings the produce of the arpent ſowed in rows, at leaſt to an equality with that of the other arpent. But a very conſiderable advantage of the new huſbandry, yet remains to be conſidered.

The value of the produce of an arpent in the common way, can, in three years, be only equal to the value of one crop of wheat and one third of a crop; becauſe a crop of oats is reckoned equal to but one third of a crop of wheat: therefore the produce of three years will be only 130 buſhels and two-thirds; whereas the arpent, cultivated according to the new huſbandry, will yield three crops of wheat, which, ſuppoſing them equal to that of the firſt year, will amount to 210 buſhels in the ſame ſpace of time. The increaſe is thus one third greater, beſides the ſaving of dung.

Reſult of the Experiment at Acou.

In this experiment, both the arpents were dunged; as well that cultivated in the old, as that in the new way.

The arpent cultivated in the new way produced 150 buſhels or 3150 pounds.

The arpent cultivated in the old way produced 133 buſhels and one-third, or 2800 pounds. Thus the produce of the former, exceeded that of the latter by 16 buſhels and two-thirds, or 350 pounds; which make a clear gain of one-eighth: to this muſt be added eight or ten buſhels ſaved in the ſeed: the profit will then amount to 24 buſhels and two thirds; or 518 pounds. On calculating the produce of the two arpents for three years, it will be found that the arpent cultivated in the old way will yield but 177 buſhels and ſeven-ninths; whereas the arpent cultivated in the new method will produce in three years 450 buſhels. Thus, beſides the ſaving of the ſeeds for oats, there will be in three years a clear profit of 272 buſhels and two-ninths. A vaſt advantage in favour of the new huſbandry.

As we have already, in treating of the diſeaſes of corn, mentioned the cauſes which make it moſt liable to be lodged, we ſhall here paſs them over, and only obſerve, that, in confirmation of the opinion already given, Mr. Duhamel ſaw with pleaſure, that tho' the corn

corn was lodged in ſeveral fields near that where the experiment was made, the wheat which grew in rows eſcaped being laid, notwithſtanding the length of the ſtalks, and the largeneſs of the ears which were very full of grain. We may therefore hope, that by following the new method, there will be leſs danger of this accident, which ſometimes robs the farmer of the fineſt part of his crop. I wiſh I could promiſe as much for its preventing the blight in wheat: but this ſeemed to affect equally both that which was ſowed in the common broad cart-way, and that which was planted in rows. 'Tis true, that fewer of thoſe blighted plants remained in the rows, becauſe the huſbandman, by means of the alleys, eaſily picked them out.

A farmer at Acou, ſeeing us place our greateſt hopes of ſucceſs on the frequent ſtirring of the ground while the wheat was in it, and our allowing each plant ſufficient ſpace to extend its roots, and collect the more nouriſhment, tried an experiment which appeared to him very proper to diſcover the truth of our reaſoning.

He carefully cultivated a grain of barley, which grew by chance in his vineyard. This plant, ſaid he, grows by itſelf; it can extend its roots every way; it is in a rich ſoil, and cannot want for food: by joining frequent culture to theſe advantages, this plant of barley, according to the principles of the new huſbandry, ought to yield a ſurpriſing increaſe. His reaſoning was juſt, and was confirmed by the experiment; for this ſingle grain of barley produced two hundred ears, and about thirty ſtalks which had no ears. Some of the ſtalks were four feet high, and moſt of them three. I counted 24 grains in a middling ear. Thus one grain, planted in a good ſoil, and well cultivated, produced 4800 grains; and the ſtraw of this ſingle plant of barley, makes of itſelf a ſheaf, which I keep by me.*

It is proper to obſerve, that I have computed the weight of a buſhel † of wheat at 21 pounds, tho' its weight varies every year.

* The reverend Dr. Hales informs me, that a grain of barley, which Mr. Hallier ſowed in his garden in the year 1720, produced an hundred and fifty-four ears, which contained 3300 grains: theſe he ſowed the next year, at the diſtance of three inches from one another: they yielded him ſomewhat more than a buſhel; which, being ſowed again, produced the third year, forty-five buſhels and a quarter.

† *i. e.* The French buſhel: *vid.* Table of weights and meaſures.

SECT. II.

Continuation of the Experiments at Denainvilliers and Acou, in the year 1751.

I. *At Denainvilliers.*

THE alleys of the arpent cultivated in the new way, and of which we ſpoke in the foregoing ſection, were ſowed in October 1750, with wheat, in rows, as before; and the beds on which the wheat grew the former year, were now turned into alleys. The other arpent cultivated in the old way, not being in a condition to bear a crop of wheat in 1751, the owner, ſatisfied with the produce of the other arpent, ſowed this with ſpring-corn, in beds, in order to prepare the ground for wheat in October following. He dunged the beds before the ſpring-corn was ſowed, and the crop was a very good one for the year.

Both theſe arpents, which were now cultivated in the new way, were bordered on each ſide by two pieces of ground of equal extent and like quality of ſoil. They were both in fine tilth, well dunged, and ſowed with wheat in the common way. By this means we were properly enabled to carry on our compariſon, the owner having promiſed to keep the crops of each of theſe ſpots ſeparate, and to give us an exact account of their produce. I muſt indeed confeſs, that of theſe two pieces of ground, that which I choſe to make my compariſon by, was ſomewhat better than the other, which may of courſe ſeem to diminiſh the advantage of the new culture.

The cold rains which fell during all the ſpring and ſummer of this year, greatly damaged every production of the earth, and eſpecially wheat. It is therefore no wonder if the produce of our experiment was much leſs this year than the laſt. It is enough for our purpoſe, that the new culture ſtill preſerved the ſame advantage over the old, that it did the year before.

At the end of ſpring, and during the whole ſummer, the wheat of the rows was much taller, and of a livelier green than that which was cultivated according to the old huſbandry; and tho' the grains produced but 3, 4, or 5 ſtalks a-piece, inſtead of 8, 12, 15, or 20, which they yielded the year before, yet they branched more than what was raiſed in the common way.

At harveſt, the rows were free from weeds, and tall enough to be reaped; whilſt the wheat which was ſowed in the common way, was

was ſo ſhort and full of weeds, that it was obliged to be mowed, and the weeds to be dried, like hay. Each of theſe fields produced 336 ſheaves. This is very different from what it was the year before, when a ſingle arpent cultivated in the ſame manner, yielded 476 ſheaves.

In our experiment, the arpent which yielded 70 buſhels, or 1470 pounds of wheat in the year 1750, yielded this year but 40 buſhels or 966 pounds of good wheat free from ſmut.

The other arpent which was cultivated in the old way and had been well dunged, and which produced 98 buſhels, or 2058 pounds of fine wheat in the year 1750, yielded this year but 38 buſhels and a half, or 808 pounds and a half of ſmall wheat, above a third of which was blighted and ſmutty.

We ſee by this account; 1. That the arpent cultivated in the new way yielded this year 504 pounds leſs than in 1750.

2. That the arpent cultivated in the old way, produced 1249 pounds and a half leſs than in 1750.

3. That the arpent cultivated according to our principles in 1751, produced 157 pounds and a half of fine clean wheat, or near one fifth more than the arpent cultivated in the common way, which yielded only a ſmall grain, mixed with a great deal of ſmut.

4. We muſt not forget that 12 buſhels of wheat were employed to ſow the arpent which was cultivated in the common way, and that not quite two buſhels were uſed in ſowing that which was cultivated according to our principles. The 10 buſhels, or 210 pounds of wheat thus ſowed, muſt conſequently be added to the 157 pounds which this arpent produced more than that with which it is compared. The gain is therefore 367 pounds.

5. This is not all. The wheat of the rows was choice corn, very fit for ſeed, and ſold for a third part more than that which was cultivated in the common way; which was of a very ſmall grain, extremely ſmutty, and full of ſeeds of weeds.

Where I ſaid that the wheat of the rows was not blighted or ſmutty, I would not be thought to impute that wholly to the new culture. The care which the owner took from time to time to pluck up the faulty ears as faſt as they appeared, contributed greatly thereto; though it is certain that even if he had not taken that pains, his wheat would have been much cleaner than that of the neighbouring field.

Mr. Du Hamel mentions a ſlip of land which was too narrow to be formed into beds, and on which the owner was notwithſtanding willing to try the new culture. He made it into one large bed, in which he ſowed ſix rows of wheat, and horſe-hoed the vacant ground on both ſides. He hoped that ſix rows would be as much benefited by the hoeing, as three: but he was miſtaken; for at harveſt, the two outſide rows were very fine, the next to them were leſs, and the two middle rows were no better than the wheat in a common field.

II. *At Acou.*

THE ſpot of ground, which was cultivated at this place according to our principles in the year 1750, yielded, as we obſerved before, 150 buſhels an arpent; and the other ſpot which was cultivated in the common way, yielded at the rate of 133 buſhels and a half. The firſt ſpot, which was not dunged, produced 83 buſhels and one third in 1751. This year's crop fell conſequently 66 buſhels and two thirds ſhort of the preceding year's. The owner was however well ſatisfied with this crop: for the land in the beſt tilth and beſt dunged in the common fields, having produced but 48 buſhels an arpent, he had a profit of 27 or 28 buſhels, including the ſaving in the feed.

SECT. III.

Continuation of the experiments at Denainvilliers and Acou, in the year 1752.

I. *At Denainvilliers.*

THE ſame arpent which was at firſt cultivated in our new way, was again ſowed with wheat this year, and without being dunged.

It now produced but ſixteen buſhels. This may be partly imputed to the hail that fell on the 10th of July, which greatly damaged this ſpot as well as all the neighbouring fields. But, independent of this accident, it muſt be owned that the corn never promiſed well. It was ruſted whilſt in blade, like that of all the other fields; but the rains which fell towards the end of July, and the hoeing which it received at that time, quickened the vegetation: the plants which had not branched at the proper ſeaſon, made freſh ſhoots, and produced ſmall ears, which were too backward to ripen, becauſe there was a neceſſity of cutting down the whole when the grain

grain in the principal ears had attained its full growth. We think we can affign feveral reafons for this accident. 1. The feed was fowed late: and we think it is neceffary, according to our method, to fow it early. 2. As the alleys were cultivated by hand, the owner contented himfelf with deftroying the weeds by a flight hoeing, as is done in gardens: hence arofe this double inconveniency; that the wheat then growing was not well cultivated, and the foil was not fufficiently prepared for the enfuing crop. This will happen no more; becaufe the ground will be well plowed for the future. 3. The variety of bufinefs neceffary to be done in the common field, frequently prevents many things being performed at the proper feafon; and the not being able to horfe-hoe this fpot early enough in fpring, hindered the plants from branching fo much as they might otherwife have done. This obfervation fhews the importance of hoeing at the propet feafons; and will more fully appear hereafter, from M. de Chateau-vieux's experiments.

II. *Experiments made at Denainvilliers, in order to know whether it be moft profitable to fow in two rows, or in three.*

IT is not yet determined whether it be moft profitable to fow, as we have hitherto done, three rows at feven inches diftance from one another, leaving the alleys four feet wide; or to fow only two rows in each bed allowing but three feet for the alleys.

To know by experience which of the two ways would be beft, we fowed a field, partly in three rows, and partly in two.

This field was reaped the 8th of Auguft, tho' the corn was not quite ripe, becaufe it would otherwife have been eaten up by birds. We cannot therefore fay whether the two rows or the three would have produced moft in proportion. All that could be done was to make the following obfervations.

An equal number of fheaves, and equally large, was gathered off from each.

The ftraw of the two rows was much longer than that of the three rows, and the ears of the two rows were much the biggeft and longeft.

All who faw the field, believed there was at leaft as much corn, if not more, on the beds which had but two rows, as on thofe which had three.

III. *Continuation of the experiment made at* Acou *in the years* 1751 *and* 1752.

THE ſame ſpot of ground continued to be cultivated according to our principles, without dung, and yielded this year after the rate of 70 buſhels an arpent.

Inſtead of ſowing, according to the uſual way, twelve buſhels of wheat ſteeped and limed, only two buſhels were uſed to an arpent: The crop may therefore be eſtimated at leaſt 80 buſhels of very fine wheat.

The owner of this ſpot had no ground ſowed this year in the old way, with which a compariſon could be made: but he was well ſatisfied with his crops, which yielded him at leaſt forty for one.

SECT. IV.

Experiments made at Denainvilliers *in the year* 1753.

THIS ground was badly cultivated in the year 1752, as we obſerved before, and the crop ſuffered by it. It was then ſowed, part with common wheat, and part with Smyrna wheat. Our intention was to try whether this laſt grain, which requires a great deal of nouriſhment, and which for that reaſon does not anſwer well in the common huſbandry, would do better when cultivated after our method. But this corn, which was ſowed too thin at firſt, ſuſtained a conſiderable loſs before it could be reaped. The ſingularity of the grain drew numbers of curious people to ſee it, each of whom gathered at leaſt ſome ears, and others a quantity, in order to ſow it in their gardens. Notwithſtanding all theſe loſſes, the common and the Smyrna wheat together produced 76 ſheafs and one-fourth, an arpent, which yielded 500 pounds of fine corn. Forty-ſix buſhels, weighing 960 pounds, is reckoned a good return from an arpent of the ſame kind of ſoil cultivated in the common way; from which muſt be deducted at leaſt four buſhels, or 84 pounds, for the extraordinary quantity of ſeed employed in that way. The produce of an arpent cultivated in the common way is hereby reduced to 876 pounds: but none yielded near ſo much this year. However, ſuppoſing the crop of the arpent cultivated according to our principles, to be leſs than that of the other, by 380 pounds; ſtill it will be found that the produce of the field cultivated in the common way will amount to no more than 1173 pounds in three years; whereas even on the footing of our diminiſhed crop, the arpent cultivated in the new way will produce 1488 pounds of wheat in that ſpace of time.

SECT.

SECT. V.

Experiments made at Denainvilliers *in the year* 1754.

THE alleys having been very well ſtirred laſt year with the hoe-plough, we had reaſon to expect a plentiful crop this year, though the ſeed was ſowed ſomewhat late. It produced about 50 buſhels and a half, or 1060 pounds of wheat an arpent; which is a good return for the kind of ſoil on which the experiment was tried; eſpecially if we add to it at leaſt 60 pounds ſaved in the ſeed.

What I ought not to omit is, that half the crop conſiſted of Smyrna wheat, and that it has not degenerated in the three years that it has now been cultivated according to the new huſbandry.

SECT. VI.

Experiment made at Denainvilliers *in the year* 1755.

OF the two fields which have been cultivated theſe ſeven years paſt according to the principles of the new huſbandry, one, which was badly plowed in 1754, yielded but an indifferent crop. That of the other field was good. In 1755, we had reaſon to be ſatisfied with the products of both theſe fields, compared to the other crops of wheat in this country, which, in general, yielded but very little grain.

SECT. VII.

Experiments made by M. Diancourt, *captain aid-major to the regiment of French Grenadiers, in the years* 1753, 1754, and 1755.

IN the beginning of November 1752, M. Diancourt ſowed, according to our method, ſix perches of land, at 22 feet to the perch, with Flanders wheat. As only three or four grains of it came up, he ſowed the ſame ſpot again, towards the end of November, with common wheat, which roſe well and throve perfectly.

As M. Diancourt had ſowed only two rows of wheat, which took up about ſix inches in breadth, and had left alleys ſix feet wide between his rows, he juſtly regretted that only a thirteenth part of his ground was occupied; and, in order to employ it to more advantage, he reſolved in April to ſow a row of barley in the middle of each of thoſe wide alleys.

It is proper to obſerve, that this ground had not had any winter plowing, becauſe it is not of ſuch a nature as to retain wet. Nor was it plowed in the ſpring, becauſe the alleys ſeemed to be clear of weeds: but as M. Diancourt himſelf acknowledges, this laſt plowing is of conſequence, becauſe it gives the corn freſh vigour, and begins to prepare the earth for the next ſowing. However, the barley grew very well; but there was a neceſſity for pulling it up towards June, in order to plow the alleys; becauſe the wheat had branched ſo much, and its blades were grown ſo long, that, covering the ground from 18 to 24 inches round, the horſe was obliged to go almoſt in the middle of the alleys, that the ſhare, which followed in a parallel direction, and at a ſmall diſtance from the rows, might turn the earth up towards them, and lay new mould about the plants.

The tufts of wheat had from 20 to 93 ſtalks; and moſt of them from 40 to 72. What made theſe plants ſo very fine, was, that their roots could extend themſelves freely in the alleys which were very wide, and in the rows where the ſeed had been ſowed very thin: but at the ſame time a great deal of ground was loſt, as M. Diancourt obſerves. I return to his experiment.

The evening before St. John's day, a violent hurricane beat down all the plants of this experiment, without breaking ſcarce any of the ears. A ſpot of ten perches, which could not be cultivated with the plough, but had been dug twice with the ſpade, and looked very fine on the 15th of April and 10th of May, was hurt more than any other part. But the damage was repaired in 24 hours, by hand-hoeing freſh earth round about the plants, which had ſo good an effect that they were not at all injured by a very high wind which blew ſome time after.

I ought not to omit obſerving, that, from the beginning of ſpring, I always turn the earth up towards the rows. It is attended with three advantages. 1. This new mould gives additional nouriſhment to the wheat. 2. It ſupports the plants, and prevents their being laid ſo eaſily as otherwiſe they might. 3. This operation forms a large furrow in the middle of the alleys, which being filled up after harveſt, and the bed then made over that furrow being raiſed high and arched above the level of the ground, the next ſown plants have an excellent depth of mould to ſtrike their roots in.

The wheat of this ſpot had begun to bloſſom before the hurricane on the eve of St. John; and within a week after it was hoed, M. Diancourt was greatly ſurpriſed to ſee it all in full bloom, and ſo full of of sap as to nourish and bring to maturity several little ears from which nothing was expected, and which nevertheless grew four inches long. Unluckily those small ears did not ripen till after the large ones, many of which were seven inches long, and one of which contained 101 grains.

One perch of 22 square feet produced 18 pounds 13 ounces of fine wheat. If we multiply this quantity by 10, to have the produce of the whole spot of ground, or by 100, to have that of an arpent, we shall be surprised at the plentifulness of this crop, reaped from a field in which so much ground seemed to lay useless. M. Diancourt says, that the lands of his farms produce one with another, from five to eight *septiers* an arpent, that is to say, from 60 to 96 bushels; (the arpent of 100 square perches, and the perch of 22 feet;) and as the *septier* weighs about 260 pounds, it follows that the common produce of a perch is at most 20 pounds, which is much less than lands cultivated in the common way sometimes produce. M. Diancourt, having cut down a square perch of wheat, so extremely fine that it was the admiration of every one, it yielded him 32 pounds of grain. As the farmer had sowed this perch with two pounds and a half of wheat, and M. Diancourt sowed at most but half a pound, the real produce of the perch was 30 pounds. Now as all that this farmer can expect from his land in three years is, one crop of wheat, and one crop of spring corn, which is valued at a third of the crop of wheat; he can have in three years no more than the equivalent of 40 pounds of wheat: whereas M. Diancourt, who reaped but 18 pounds thirteen ounces, deducting the seed for three years, after the rate of 8 ounces a year, which is one pound eight ounces in all, will have remaining neat for his three crops 51 pounds 15 ounces, which is 11 pounds 15 ounces more than the farmer's crop. To judge rightly of the advantage of the new husbandry, it must be observed, 1. That M. Diancourt says he chose the finest perch in forty arpents of land, to make his comparison by. 2. That he tells us his alleys were too wide. 3. That the seed of the oats is not reckoned in this calculation. If, with all these advantages on the other side, the profit was one fifth in his favour, how much greater would it have been supposing a parity of circumstances?

M. Diancourt likewise sowed three other spots of wheat, *viz.* one of 12 perches and a half, another of 10, and the third of four. The alleys of these three spots were plowed in the beginning of May. The plants here suffered much less by the hurricane, than those we

 spoke

ſpoke of before: their ſtalks were only bent; but ſo much indeed as to hinder the plough from paſſing in the alleys. To remedy this, M. Diancourt ordered them to be earthed-up with a ſhovel, and then the plough was able to work. 'Tis true this did not re-inſtate them ſo well as the huſbandman had done thoſe in the laſt mentioned piece of ground: but however, they kept upright till the third and laſt plowing, which was given towards the end of July.

The fineſt tufts on theſe grounds had not above ſixty ſtalks; but on the other hand very few had leſs than twenty. M. Diancourt ſays nothing farther of theſe three ſpots: but he inſiſts ſtrongly on the following experiment which he made with ſpring corn.

In March, M. Diancourt ſowed ſpring wheat in ſingle rows, three feet aſunder, and the grains in the rows at the diſtance of eight inches from each other. The farmers of that country, ſurpriſed at what he was doing, aſſured him that his crop would never yield above a few pints. To convince them by their own experience, M. Diancourt propoſed to one of them to ſow in his own way, a ſquare bordering on, and exactly like that which he had ſowed in this new way.

From the time of ſowing, till within a month of harveſt, the farmer's field promiſed infinitely more than M. Diancourt's, who could hardly perſuade himſelf that he ſhould have even tolerable ſucceſs, when he compared his 18 little ſingle rows, three feet diſtant from one another, with the farmer's field which was covered like a meadow. But a little before harveſt, the ears of the rows appeared from four to ſix inches long and very thick; whilſt thoſe of the farmer, which ſuffered by drought, were very poor, and not above an inch or two in length. In ſhort, the farmer who had ſowed 34 pounds of grain, reaped neat 126 pounds and a half; and M. Diancourt, who had ſowed but an ounce, reaped betwixt 92 and 93 pounds. Thus, the farmer's crop in three years would amount at moſt to the value of 169 pounds of wheat, whilſt M. Diancourt's would be 279 pounds; which is almoſt double the other.

In March 1753, M. Diancourt prepared two arpents of ground in his park, in order to ſow them with wheat the next September: and that this ground might not be uſeleſs during the ſix intermediate months, he laid it out in beds, in June, and planted them with beans, ſome in ſingle and others in double rows; the beans being a foot aſunder in thoſe rows. In the beginning of October, an immenſe quantity of beans was gathered off this ſpot. The ſingle rows produced as many as the double ones. Some ſtalks had upwards of 180 pods.

This prodigious fertility can be aſcribed to nothing but the good culture of the ground: which, to me, is a ſtrong proof that the great ſucceſs which many have imputed to the effect of certain myſterious ſteeps or infuſions, has, in fact, been owing ſolely to the goodneſs of the ſoil and the proper culture of it.

In order that plants raiſed according to our principles may enjoy the benefit of the culture of the alleys, their roots muſt be able to extend themſelves to a pretty conſiderable diſtance. This reflection made M. Diancourt take up carefully ſome of his plants of beans and wheat, to examine their roots.

The roots of the beans extended, in general, upwards of three feet from their ſtock. Almoſt all the roots of a grain of wheat which had produced 93 fine ears, were from 15 to 18 inches long; but inſtead of ſpreading horizontally, like thoſe of the beans, they ſhot down perpendicularly.. From hence it may be concluded that it is needleſs to make the alleys ſix feet wide; but highly proper to give the beds the greateſt depth of looſe mould that the ſtaple of the ſoil will admit of, either by plowing deep, or raiſing the earth high where the rows are to be planted.

M. Diancourt ſowed eight perches of land, with oats, in double rows, and alleys ſix feet wide. The moſt prejudiced againſt the new huſbandry were forced to own, that two of his rows produced more grain than the whole eight perches would have done if ſowed in the common way.

There are two kinds of inſects in M. Diancourt's grounds, which gnaw the roots of wheat. Our gardeners call one of them the red worm: the other is the millepedes or Scolopendra. M. Diancourt has begun experiments in order to try whether they cannot be guarded againſt by earlier or later ſowing of the ground that is infected with them. The event of theſe trials, which M. Diancourt juſtly looks upon as very intereſting, is yet uncertain: but M. Diancourt obſerving one day a tuft of wheat which languiſhed, judged that its roots were preyed upon by theſe inſects. To ſatisfy himſelf therein, he pull'd up the tuft, and found a worm in it. He then cut off half the length of the leaves and roots, planted the tuft again, and watered it, becauſe the earth was extremely dry. The tuft grew very well, and produced 12 well conditioned ears, four inches long.

M. Diancourt varied his experiments for the next year, by ſowing ſingle, double, and triple rows, ſome very early, and others very late. He could not attend the progreſs of theſe trials himſelf, being called away to the army: but the reſult, as he informed M. Duhamel, was, that he was convinced that corn planted in the new way is much leſs liable to be lodged than what is ſowed in the old. With regard to the advantage of ſowing very early, to be ſatisfied in which M. Diancourt ſowed ſome rows the 9th of Auguſt, and others the 1ſt, 5th, 10th, and 15th of September, he obſerved that the rows which were ſowed the 9th of Auguſt, ſpindled but five days earlier than the wheat in the common way, and that the ears were but midling: nor did the rows which were ſowed the 1ſt, 5th, 10th, and 15th of September ſpindle much ſooner than other common wheat; and a ſpot ſowed in ſingle rows, produced as much as the ſame extent of ground ſowed in double and in triple rows.

From theſe experiments, M. Diancourt was tempted to conclude, 1. That the right ſeaſon for ſowing is in the month of September, and the firſt day of October. 2. That it is more profitable to ſow in ſingle rows, than in double or triple ones. However, he would not, ſaid he, pretend abſolutely to determine theſe points, till he ſhould have had at leaſt three years experience.

One of the pieces of wheat from which M. Diancourt expected moſt, and which in fact promiſed greatly at firſt, ſuffered a ſudden and almoſt total change, the plants decaying viſibly from day to day. Surpriſed at this accident, he ordered the whole ſpot to be turned up in his preſence, in order to diſcover the cauſe; when he found the whole length of the ground immediately under the rows, hollowed by moles and field-mice, drawn thither, in all probability, by ſome remaining roots of turneps with which that ground had been planted the year before.

M. Diancourt continued his experiments in the year 1755, in the ſame manner as before, and with ſtill greater ſucceſs.

SECT. VIII.

Experiments made by M. DE LA CROIX, *at Verdun on the Meuſe, in* 1755; *extracted from a Letter of his to* M. DU HAMEL.

IN the year 1755, being convinced of the ſolidity of the principles of the new huſbandry, I deſired M. de Chateau-vieux to buy me a drill-plough. I received it, well conditioned, towards the end of

July,

July, and ſent it in September to Hermeville, a village about nine miles from Verdun. I agreed with the farmer of an eſtate which I have there, for three arpents of land, on which I purpoſed to make my trials.

This ſpot had received the uſual plowings in the common way. I divided it into four almoſt equal parts; one of which I deſtin'd to be ſowed in the old way; the ſecond, to be ſowed in equally diſtant rows with the drill-plough; the third, to be laid out in beds five feet wide; and the fourth, in beds of ſix feet.

I was preſent whilſt the firſt four or five beds were made; and after marking out the others, left the finiſhing of them to my farmer, not imagining he could miſtake: however, he did; ſo that I had in all twenty-five beds, *viz.* but three of ſix feet, and twenty-two of five feet.

We ſowed the next day, which was the fifteenth of September, the weather being very fine. We began with the beds, twenty-two of which were ſowed with three rows, and three with ſix. Theſe beds took up an arpent and an half of ground, and 21 pounds, 1 ounce, and 2 pennyweights of ſeed.

Immediately after, I ſowed in the common way the ſpot prepared for that purpoſe, with 63 pounds, 4 ounces, and 2 pennyweights of ſeed.

Whilſt this part was harrowing, the third ſpot was ſowed in equally diſtant rows with the drill-plough, and took up 25 pounds, 5 ounces of ſeed.

All theſe operations were performed in three hours and an half. I was ſurpriſed at the eaſe with which we did them, conſidering that this was the firſt time we had uſed, or even ſeen a drill-plough. The only fault I found in it, was, that it bruiſed and ground ſome of the grains. However, my ground was ſufficiently ſtock'd with plants, excepting the part that was ſowed in equally diſtant rows, in which there were here and there ſome chaſms, occaſioned by our not having kept the drill in a parallel direction in ſome places.

Some time after, I gave directions for making a ſmall plough with one wheel, to turn up my alleys. Unfortunately, this inſtrument could not be got ready before the rains which began in October; ſo that I could not give the latter plowings which I intended. However, only two or three of my beds ſuffered at one end, where the ground had not ſlope enough for the water to run off.

The month of March being likewiſe very rainy, and not having leiſure to go into the country, my alleys ſtill remained without culture, which they received for the firſt time the twenty-firſt or twenty-ſecond of April, with my ſmall plough.

A month after, that is to ſay, about the twentieth of May, my alleys were plowed again with the cultivator. This was of great ſervice to the ground, by breaking the clods which my ſmall plough had left in April. From this time, I conceived great hopes: my plants branched out conſiderably; their blades grew very large, and of a deep green; whilſt the wheat in the neighbouring fields was poor and ſtinted, and of a yellow green.

I could not poſſibly give my alleys any other plowings after May, by reaſon of the rains which were almoſt continual.

In the beginning of Auguſt I viſited my corn, which did not yet ſeem thoroughly ripe; eſpecially that of the beds: but it was incomparably finer than the neighbouring wheat; the ſtalks were much ſtronger, taller, and more vigorous than any in the common way, and the ears at leaſt twice as long and well filled. I judged that they would require a fortnight more to ripen them: but a few very hot days made them turn yellow, and they were reaped at the ſame time as the other wheat of the country.

I ſay nothing of the rains which hurt the harveſt, nor of the quantity of weeds which the wetneſs of this year produced in all lands, and particularly in the beſt. Like others, I had a great many weeds in my ground; but the ſtrength and tallneſs of the wheat in the beds, and in the part that was ſowed with the drill-plough, got ſo far the better of thoſe enemies, that the crop ſuffered little by them.

The part ſowed in the common way, and for which 63 pounds, 4 ounces, and 2 pennyweights of ſeed was uſed, yielded 480 pounds of grain, after deducting the tythe: conſequently the neat produce was 417 pounds. The products of other parts of this field (the tythe likewiſe deducted) were as follows. The ſpot ſowed in equally diſtant rows, with the drill-plough, and with 25 pounds 5 ounces of ſeed, yielded at leaſt 500 pounds of grain, and would certainly have produced more, had it not been for the miſmanagement of the drill-plough, which I mentioned before. The neat produce here, was therefore 474 pounds, 11 ounces. The beds which were ſowed with 21 pounds, 1 ounce, and 2 pennyweights of ſeed, yielded 660 pounds; and for their neat produce, 638 pounds, 14 ounces.

I ſuppreſs all the reflections which naturally occur in favour of theſe

these trials, imperfect as they were: but to prove ftill more how advantageous it is to fow the feed at fufficient diftances, I fhall mention a little experiment which I made in my garden. I planted in a bed, about thirty grains of wheat, feven or eight inches diftant from one another. Each grain produced its plant, which I cultivated carefully at the proper feafons, and particularly in the fpring: that is to fay, I gave the earth round thefe plants a good ftirring, before they branched, before they fpindled, and before and after they had bloffomed. They grew fo prodigioufly, that one would fcarcely have taken them for common wheat. The ftalks were upwards of four feet high, exclufive of the ear; the blades were above two fingers broad; and they remained thus beautiful till the beginning of July, when they were feized with the *ruft*. The very day on which I perceived this accident, was exceffively hot and fultry, and had been immediately preceeded by a very thick fog. This, doubtlefs, occafioned an extravafation of the fap. I let thefe plants ftand till the grain was thoroughly ripe, and then I plucked them up. Their roots were much longer, and fpread a great deal wider than thofe of any wheat in the common way. I reckoned the number of ears upon each plant, and found that the pooreft of them had produced from 35 to 40, and that many had from 80 to 90: three, in particular, had 102, 104, and 105 ears. I counted 42 grains in one ear.

SECT. IX.

Experiments made near Guignes, in the Province of Brie, under the Direction of M. Roussel, *in* 1755.

M. Rouffel prudently began, as we would advife every one to do, with fmall experiments. His firft trial of the new hufbandry was upon a little fpot: but being prevented from attending to it in perfon, many faults were committed during his abfence. On his return, which was towards the end of November 1754, he inquired after his crop, and learnt, with pleafure, that fome grains had produced upwards of 60 ears a-piece, and that many of thefe ears contained 64 grains. This was fufficient to fhew him the excellence of the new culture, which he immediately determined to extend to larger objects.

He had no time to lofe. Two contiguous pieces of ground, containing 20 arpents, had been folded, and were juft going to be plowed for the laſt time, in order to be ſowed according to the uſual practice of the country. Theſe were choſen for the farther trial of the new huſbandry, and were accordingly ſown with our drill-plough, between the ninth and twenty-firſt of October, with 27 buſhels and 4 pounds of wheat, including 10 pounds and an half, which were uſed to fill up ſome ſpaces where the ſeed had miſſed.

At the ſame time, an adjacent piece of ground which had been folded like the former, and of which the ſoil was equal to the beſt part of the field ſowed in rows, was ſown in the common way. This laſt contained three arpents and three quarters, and took up 23 buſhels of ſeed; which is ſeven buſhels and one-third to each arpent.

The corn came up finely in both fields: but that which was ſowed in rows happened to be near a wood, from which numbers of rabbits came and entirely deſtroyed the plants of four arpents: the roots which they left, were eaten up by worms; and the dung of the ſheep-folds produced a great quantity of weeds. This was not all: as the furrows did not run in the direction of the declivity of the ground, the water lodged in them, ſo that the firſt plowing, which ought to have been given in March, could not be performed till April, when it left a great many clods.

Theſe clods were grown hard by the time of the ſecond plowing, which was performed with a plough with two mould-boards, which inſtead of breaking and looſening the ground, and laying freſh earth to the roots, only turned thoſe hard clods over upon the rows.

The third plowing, which was given with a plough with two ſhares, and in more favourable weather, had a better effect.

Notwithſtanding the accidents which had reduced this piece of wheat to ſo wretched a condition, that the plowmen told their maſters they were ſure it never would produce a crop worth reaping, and that all their labour was thrown away: yet, reckoning upon the footing of 20 arpents, though it would be but juſt to deduct the four which were abſolutely deſtroyed by the rabbits; and ſuppoſing too, the crops of 1756 and 1757 to be no greater than that of 1754; M. Rouſſel's calculation proves, that even then theſe three crops will ſtill be better than what the ſame field would produce in the common way.

But, ſays M. Rouſſel, if we do the new huſbandry part of the juſtice it deſerves; and, inſtead of including the four arpents which the rabbits deſtroyed, we reckon only the produce of 16 arpents, prepared in a hurry, and badly plowed; and even ſuppoſe them to be no better managed in the following years, and the whole extent of the 20 arpents, to be only of the ſame quality as the 3 arpents and three quarters with which it was intended to be compared; the produce of both, in three years, will be as follows.

The 16 arpents produced 552 buſhels of wheat, which was preferred to any other for ſeed, not only becauſe it was finer, but likewiſe becauſe it was quite free from all ſeeds of weeds. This is after the rate of 34 buſhels and an half for every arpent.

From this, we are to deduct the ſeed, which is, for each arpent, one buſhel and ſeven pounds and an half.

The neat produce of each arpent, will then be 33 buſhels and three pounds of wheat, free from all ſeeds of weeds.

Suppoſing the crops to be no greater in the following years, tho' what we ſhall ſay hereafter will ſhew that they certainly will, each arpent will have produced at the end of three years, 99 buſhels and nine pounds of wheat.

The other piece of ground, which was cultivated in the old way, in order to make the compariſon, produced 60 buſhels an arpent, from which we are to deduct 7 buſhels and 19 pounds, for the ſeed.

The remaining neat produce is 52 buſhels and 2 pounds.

The ſecond year's produce of this ſame arpent, ſowed with ſpring-corn, can be reckoned at only half the value of the firſt year's crop of wheat; and the third year produces nothing, being the year of fallow.

Thus the total neat produce of the arpent cultivated in the common way, will be, at the end of three years, only 78 buſhels and 3 pounds; whilſt that in the new way, will be 99 buſhels and 9 pounds.

M. Roussel *gives the following Account of his Experiments in* 1756.

In October 1755, I choſe, in the middle of a fallow field which had been well plowed, and was not expoſed to any of the accidents I met with laſt year,* 10 arpents of ground, at 20 feet to the perch, and 100 perches to the arpent. This was ſet apart for the new huſbandry: and that I might be able to make a juſt compariſon, I mea-

* This change of ground was far from being an advantage to the new huſbandry. as M. du Hamel obſerves.

I meaſured out 10 other arpents of the ſame field, and the ſame kind of ſoil, to be ſowed broad caſt in the old way.

These laſt ten arpents were extremely well dunged by folding of ſheep upon them. With regard to the ten arpents which were to be cultivated in the new way, and which compoſed 93 beds five feet wide, including the alleys; only eight of theſe beds were dunged by ſheep, and that at the ſame time, and to the ſame degree as the ground by which the compariſon was intended to be made: of the other beds, 76 had no ſort of dung or amendment whatever; and nine were dunged more or leſs, in the manner and proportion hereafter mentioned.

Moſt of thoſe who practiſe the new huſbandry, uſe no dung at all. I ſuppoſed that their reaſon for rejecting this manure was, the difficulty of finding a proper time to apply it; for whilſt the alleys receive their ſeveral ſtirrings, no wheel carriage can be admitted with dung without hurting the beds which are ſown, and hardening the looſe mould of the alleys: to carry it on the backs of cattle, would be at beſt a very difficult, tedious, and expenſive way, where any conſiderable ſpace is to be tilled: to ſpread it upon the earth only the moment the ſeed is going to be ſowed, is a ſure way to clog up the drill-plough and hinder its operation, if the dung be not thoroughly rotten; and to breed weeds, which by no means ſuit this culture. To remedy theſe inconveniences, I contrived the following method. I opened in each of the alleys one of thoſe large furrows which muſt always be every year at the end of the ſummer hoeings, in the place where the three rows of ſeed are afterwards to be ſowed; and by drawing the plough with two mould-boards once through it, I made it 14 or 15 inches wide; which is the breadth that the three rows of ſeed require. The ſpace between two of theſe deep furrows, is exactly the breadth of a cart, the wheels of which going in them, hurt no part that has been plowed, and do not preſs down or harden the looſe mould; nor do the horſes do any damage, becauſe they neceſſarily tread upon the ſtubble of the late reaped beds, in the middle between thoſe two furrows. This was the method I uſed to dung the 9 beds in queſtion.* The dung was well rotted: it was ſpread at the bottom of the furrows, and immediately covered over by the ſame plowing that made the beds which were ſowed ſome days after. Perhaps this manure may be of more ſervice

* This, ſays M. Du Hamel, is a contrivance of great importance, and I confeſs, adds he, that I have always been puzzled how to ſpread dung in the new huſbandry.

vice to my lands than to many others, becaufe the foil is naturally cold and backward. The grain is by this means fowed upon a kind of gentle hot-bed, the warmth of which promotes the branching and vegetation of the plants. The winter rains and frofts, raife a fermentation. The firft fpring plowing, by giving it a little air, revives that fermentation at the very time when the fap is moft active, and the plant begins to branch. As the dung rots, a kind of motion is caufed in the earth, which in fome meafure anfwers the end of a flight plowing, and brings frefh nourifhment to the roots. The fame heat which confumes the ftraw, likewife confumes the little feeds that are in the dung, which might otherwife produce numbers of weeds. When this dung is brought up again to the furface of the earth, by the next year's plowings, it will no longer have thofe hurtful feeds. It will indeed have loft its heat; but it will ftill have retained all its fatnefs, which will mix with the earth; and land thus conftantly dunged, will in time become a perfectly fine mould. But if thefe layers of dung fhould be fpread too thick, or the dung itfelf be of too hot a nature, the roots of the corn might perhaps be endangered thereby. It was to determine this, that I tried the following experiments, to know the effects of different dungs, and what quantity it is proper to employ.

Three beds were dunged, in the above manner, with horfe-dung: the firft, which was 184 toifes long, had three loads of dung; the fecond, of 185 toifes, had but two and a half; and the third, of 187 toifes, had but two. Three other beds were dunged with cow-dung: one of 137 toifes, with two loads and a half; the fecond, of the fame length, with two loads; and the third, of 138 toifes, with only one load and a half. The three remaining beds had fheep's dung: the firft, of 133 toifes, two loads; the fecond, of 132 toifes, one load and a half; and the third, which was of the fame length, one load.

Thefe beds were diftributed in fuch manner, that each of them was in the middle of two other beds which were not dunged. The field, thus laid out, was fowed the thirteenth, fourteenth, fifteenth, and fixteenth of October, with your drill-plow, which plants three rows in each bed. I ufed 18 bufhels of feed; and afterwards half a bufhel, to fill up the chafms; which is after the rate of one bufhel and 18 pounds to an arpent, and confequently a little too much. Accordingly, when the corn came up, I faw it was too thick fown. The reafon was, that the grain was too fmall, and not pro-

portioned

portioned to the outlet of the drill-plough. At the end of ten days, this corn rose well. On the eighteenth of December, I obſerved that moſt of theſe plants had branched into four ſtalks, whilſt thoſe in the common way had but three. I perceived no ſenſible difference then, between the dunged and the undunged beds. It was not till the twenty fourth of January that I ſaw plainly that the plants of the dunged beds were of a deeper green, and had made longer and more vigorous ſhoots than thoſe of the undunged beds. By the twentieth of February, five ſmaller ſtalks iſſued out of the five great ones, which was not the caſe with the wheat in the common way. The alleys did not receive their firſt plowing till the tenth of March. Eleven of the main ſtalks grew an inch and a half in five days; and I obſerved that the moles were rather more buſy in the dunged beds, than in the others. As the earth was yet ſomewhat too ſoft, I thought it needleſs to continue a plowing which could do no good, and therefore poſtponed it to the twenty-eighth of March, and following days. The ninth of April, I found a plant with 18 ſtalks in one of the dunged beds: the greateſt number of branches that any of the plants in the undunged beds had, was twelve: but on the other hand, I likewiſe found ſome which had eighteen in the field of compariſon ſowed in the common way. The ninth of May, this ſame plant had 20 ſtalks; and from that time it branched no more. The ſecond plowing was not given till three weeks after, *viz.* the twenty eighth of May; which, I think, was ſomewhat too late after the corn had ceaſed to branch. The twenty third of June, there were three ſorts of wheat in all the beds: there were ears in bloſſom, others juſt going out of bloom, and others not yet out of their hoods. The fineſt ears were thoſe which came up and bloſſomed firſt. The moſt forward beds were thoſe which had been dunged under furrow, with ſheep's dung: the next to them, were the eight beds which had been folded, the plants of which were a little greener than thoſe of the undunged beds. The laſt plowing was given on the tenth of July. The grain had then begun to fill: but that in the common way was the moſt forward, though it was ſowed three weeks later than the other. I know not for what reaſon, the wheat of the new huſbandry began to be reaped the fourth of Auguſt, and that in the old way was let ſtand till the thirteenth. The product of both cultures was as follows.

In

In the 10 arpents cultivated in the new way, the three beds dunged with horse-dung, yielded,

	Sheaves.
The firſt, 184 toiſes long, dunged with 3 loads,	19
The fellow to it, not dunged,	15
The ſecond, 185 toiſes long, dunged with 2 loads and a half,	18
The fellow to it, not dunged,	14
The third, 187 toiſes long, dunged with 2 loads,	16
The fellow to it, not dunged,	13

The three beds dunged with cow dung, yielded,

The firſt, 137 toiſes long, and dunged with 2 loads and a half,	16
The fellow to it, not dunged,	11
The ſecond, likewiſe 137 toiſes long, and dunged with 2 loads,	15
The fellow to it, not dunged,	12
The third, 138 toiſes long, and dunged with 1 load and a half,	14
The fellow to it, not dunged,	12

The three beds dunged with ſheep's dung, yielded,

The firſt, 133 toiſes long, and dunged with 2 loads,	17
The fellow to it, not dunged,	10
The ſecond, 132 toiſes long, and dunged with 1 load and a half,	15
The fellow to it, not dunged,	11
The third, 132 toiſes long, and dunged with 1 load,	14
The fellow to it, not dunged,	10

The eight beds which had been folded, two of which were 185 toiſes long, three 186, and three 187, produced in all, 142
This is near 18 ſheaves apiece.

The 67 other beds, which had not been dunged, produced in all 814
This is ſomewhat more than 12 ſheaves apiece.

Total produce of the 10 arpents cultivated in the new way . . Sheaves 1208

The 10 arpents ſowed in the common broad-caſt way, after having been well folded all over, produced Sheaves 1820

Theſe facts ſhew the advantage of dunging in this manner. It is plain that the beſt dung is that of ſheep, and that it is more profitable when laid under furrow, than when it is ſpread upon the ſurface of the ground by folding.

In proportion to the product of the bed 133 toiſes long, which was dunged with two loads of ſheep's dung, and produced 17 ſheaves; the

the bed 184 toiſes long, which was dunged with three loads of *horſe* dung, and produced only 19 ſheaves, would, if dunged with ſheep's dung, have produced $23 + \frac{69}{133}$; and the bed dunged with cow dung, which yielded but 16 ſheaves, would have yielded $17 + \frac{68}{133}$.

The eight folded beds, whoſe whole length was 1489 toiſes, wonld have yielded 190 ſheaves $+ \frac{43}{133}$, inſtead of only 142 ſheaves, which was the amount of their product.

It is likewiſe plain, that an arpent of land, the meaſure of which is 10 perches by 10, the perch being 20 feet; or, which is the ſame thing, a ſurface of 200 feet, which conſequently contains 40 beds, five feet wide and 33 toiſes two feet long, which makes a total length of 1333 toiſes; it is plain, I ſay, that this arpent dunged as the 133 toiſes were with ſheep's dung, would have yielded, in proportion to 17 ſheaves on 133 toiſes, 170 ſheaves; and that my 10 arpents, in the ſame proportion, would conſequently have produced me 1700 ſheaves, which would be but 120 ſheaves leſs than the whole produce of the 10 arpents folded all over and ſowed in the broad-caſt way. If ſo, I ſay, that thoſe 120 ſheaves would not be equivalent to the quantity of grain which I ſaved by ſowing according to the new huſbandry. An hundred ſheaves yield, in general, little more than 18 buſhels, Paris meaſure. The 120 ſheaves which the 10 arpents ſowed in the broad-caſt way produced more than the 10 arpents in beds, would therefore yield but 21 buſhels and three-fifths. Deduct this from the forty-one buſhels and a half, which I ſaved in the ſeed of theſe laſt 10 arpents ſowed in the new way, and I ſhall ſtill be a gainer: for you may remember that I ſowed only 18 buſhels and a half, in this ground; whereas 60 buſhels were uſed to ſow the other 10 arpents in the common way. This would have been the produce of this firſt year's crop, ſuppoſing that the whole of my 10 arpents in beds had been dunged as the 133 toiſes were. For want of that, I reaped but 1208 ſheaves. They have juſt been threſhed, and have yielded only 240 buſhels of grain.

M. Duhamel makes the following obſervations on this account of M. Rouſſel.

The 1208 ſheaves yielded but 20 ſeptiers, or 240 buſhels of grain, from which we are to deduct 18 buſhels and a half for the ſeed. The neat produce is therefore 221 buſhels and a half, which would make in three years 664 buſhels and a half. The other field in the common way produced 417 buſhels, from which we are to deduct 60 for the ſeed: the neat produce is conſequently 357 buſhels; the half of of which is 178 buſhels and a half, for the next year's crop. This is all that the 10 arpents in the common way would produce in three years, and amounts to no more than 535 buſhels and a half: conſequently the balance in favour of the new huſbandry, in three years, is 129 buſhels, or one fourth part of the whole; and that from a field which was ſowed in rows for the firſt time, and of which three quarters were not dunged at all: whilſt the other, with which it is compared, had been folded all over, and, for the year, produced a very plentiful crop.

M. Duhamel relates ſeveral other experiments, which were communicated to him by different perſons, during the publication of his work: but as they contain nothing eſſentially different from thoſe we have already given, and, like them, were made only on ſmall pieces of ground, we think it needleſs to mention them here. We ſhall therefore proceed to the judicious and more extenſive experiments of M. de Chateau-vieux, after extracting a few paſſages from the writings of one of our own countrymen, in confirmation of the advantages of the new huſbandry.

"Deep plowing, (ſays Mr. Miller, in his Gardener's Dictionary,) where the ſtaple of the ground is deep enough to admit of it, will be of great ſervice to corn: for the ſmall fibres of the roots, which are the mouths that ſupply the nouriſhment, extend themſelves very deep into the ground. I have traced many of them upwards of three feet, and believe they ſpread much farther where the ground is light: therefore it is of great advantage to the crop to have the ground ſtirred and looſened to a proper depth: for by ſo doing, the roots will find a ſupply of paſture for the nouriſhment and augmentation of the ears, at the time they are forming, when it is moſt required: for if the ground is plowed ſhallow, the roots will have extended themſelves to that depth by the ſpring; ſo that when the nouriſhment is wanted to ſupply the ſtalks, the roots are ſtinted by the hardneſs of the ſoil, which they cannot penetrate. When this is the caſe, the colour of the blade is frequently ſeen to change in April, and ſeldom recovers its verdure again: and when this happens, the ſtalks are always weakened in proportion to the decay of the blade: for it is well known from long experience, that the leaves or blades of corn are neceſſary to draw in nouriſhment from the air and dews, for the increaſe of the ſtalk and ear.

"I have obſerved, adds he, that, in general, the farmers ſow more than double the quantity of corn on their lands than is neceſſary:

 therefore

therefore there is a great waſte of grain, which, in ſcarce years, amounts to a conſiderable ſum in large farms; and to a whole country, it is an object worthy the attention of the public: but I fear whatever may be ſaid to prevent this, will have but little weight with the practitioners of agriculture, who are ſo fond of old cuſtoms, as rarely to be prevailed upon to alter them, though they are extremely abſurd. But if theſe people could be prevailed on to make the trial with care, they muſt be ſoon convinced of their error: for if they will but examine a field of corn ſown in the common way, they will find but few roots which have more than two or three ſtalks, unleſs by chance, where there may be ſome few roots which have room to ſpread, upon which there may be ſix, eight, or ten ſtalks, and frequently many more: but in a field of wheat which had not a greater allowance than one buſhel of corn to an acre, ſo that the roots had room to ſpread, I have obſerved that the roots produced from ſix to twelve or fourteen ſtalks, which were ſtrong, and had long well-nouriſhed ears, and the produce was much greater than in any of thoſe fields in the neighbourhood, which were ſown with the common allowance. And if the land is good, and the roots ſtand at a proper diſtance from each other, there will be few roots which will not produce as many ſtalks as I have here mentioned, and the ears will be better nouriſhed.

" The horſe-hoeing huſbandry which was practiſed by Mr. Tull, has been almoſt univerſally rejected by the farmers in every country; it being ſo oppoſite to their accuſtomed practice, that they cannot be prevailed upon to make a trial of it: and indeed ſome abſurdities in Mr. Tull himſelf have greatly contributed to give them a diſguſt to it; one of which, and that perhaps not the leaſt, is, his poſitively aſſerting that the ſame land would nouriſh the ſame ſpecies of plants, without changing the crops, for ever, and this without manure *; which his own experience afterwards proved to be falſe. But notwithſtanding theſe and ſome other particulars which have been advanced by Mr. Tull, it is much to be wiſhed, continues Mr. Miller, that this new huſbandry might be univerſally practiſed; for ſome few perſons who have made ſufficient trial of it, have found their crops anſwer much better, than in the common or old method of huſbandry; and the French, who have learned it from Mr. Tull's book, are engaging in the practice of it with greater ardour than thoſe

* M. du Hamel, throughout his whole work, takes every opportunity to recommend the uſe of manures in the new huſbandry.

thoſe of our own country: and although they had not the proper inſtruments of agriculture for the performance, and meet with as ſtrong oppoſition from the perſons employed to execute the buſineſs, as in England; yet the gentlemen ſoon determined to perſiſt in the practice of it, though as yet few of their experiments have had the ſucceſs they hoped for *; partly from the awkwardneſs of their labourers, and partly from their averſeneſs to practiſe this huſbandry; and alſo from their being made in lands not well conditioned: but yet their produce has been equal to that of the old huſbandry; and they ſay, that if the produce of land in the new method of huſbandry, does not exceed that in the old way; yet, by ſaving ſeven parts in eight of the ſeed-corn, it is a great affair to a whole country, eſpecially in times of ſcarcity.

"I ſhall only mention two or three late experiments which have been made in the new way, whereby the utility of it will more fully appear.

"The firſt was in a field of wheat, which was ſown partly in broad-caſt in the common method, and partly according to Mr. Tull's method. The ſpots thus ſown, were not regular in lands, but interſperſed indifferently in many directions. Thoſe parts of the field in Tull's method were in rows at two feet diſtance, and ſtood thin in the rows. The roots of the wheat in thoſe ſpots had from ten to thirty ſtalks upon a root, and continued upright till it was reaped; whereas few of the roots in the common method, had more than two or three ſtalks, and theſe were moſt of them lodged before harveſt: ſo that upon trial of the grain when threſhed, there was near a third part more in weight and meaſure, than from the ſame extent of ground, taken in the beſt part of the field ſown in the common way.

"Another trial was made in ſowing of the corn in rows at different diſtances, with ſome ſown in two parts of the ground broad-caſt. The event was, that all which was ſown broad-caſt, in the uſual way, was lodged, as was alſo moſt of that where the rows were ſix or nine inches aſunder: thoſe which ſtood a foot diſtance eſcaped better, but the rows two feet aſunder were the beſt, and the produce much greater than any of the other; which plainly ſhews the abſurdity of the practice of ſowing a great quantity of ſeeds, to have

* Mr. Miller could not have ſaid this, if he had ever ſeen the three laſt volumes of M. du Hamel's work, and particularly the experiments of M. de Chateau-vieux.

have a better produce, which is the opinion of moſt of the old farmers.

"The produce of an acre of wheat is various, according to the goodneſs of the ſoil. In ſome of the ſhallow, chalky, down lands, where there have been near four buſhels of corn ſown, I have known the produce not more than double of the ſeed: but when this is the caſe, the farmer had much better let his land lie waſte, ſince the produce will not defray the expence; ſo that more than the rent of the land is loſt. And although theſe ſorts of crops are frequently ſeen on ſuch land, yet ſuch is the paſſion for plowing among the huſbandmen at preſent, that if they were not reſtrained by the landlords, they would introduce the plough into every field, notwithſtanding they are ſure to loſe by it.

"But although the produce of theſe poor downs is ſo ſmall, as before related; yet upon good land, where the corn has ſtood thin upon the ground, I have known eight or ten quarters reaped from an acre, over the whole field, and ſometimes more: and I have been informed by perſons of great credit, that on good land, which was drilled and managed with the horſe-hoe, they have had twelve quarters from an acre of land, which is a great produce: and this with greater certainty, if the ſeaſons prove bad, than can be expected by the common huſbandry."

Thus far Mr. Miller, whoſe remarks, we hope, will have their proper weight.

CHAP. II. SECT. I.

Experiments made by M. LULLIN DE CHATEAU-VIEUX, *Firſt Syndic of the City and Republic of Geneva, in the Year* 1751.

IN October 1750, I began my experiments on a ſpot of ground of a rich ſtrong ſoil, twenty-ſix toiſes and four feet in length, and ſix toiſes and four feet in breadth, containing 177 ſquare toiſes and 28 feet. Not being yet provided with proper inſtruments for the horſe-hoeing huſbandry, I cauſed it to be dug with the ſpade, and formed it into ſeven beds of equal ſize. Great care was taken to break the clods thoroughly, and to dig the earth very deep. The beds, which were in a looſe ſtate, were raiſed high in the middle.

The fourteenth of October, I ſowed three of the beds with wheat, two with barley, and two with oats. I muſt obſerve, that in this country, it would have been better to have ſowed a fortnight ſooner.

I made three furrows in each bed, ſo ſhallow, that the ſeed was not buried above half an inch deep. The wheat was dropt by hand, in ſingle grains, at the diſtance of ſix inches from one another. The barley was dropt at nine inches diſtance, becauſe it branches more than wheat. Though oats branch more than either, yet, as it is a tender plant, and apt to be killed by the winter's cold, I ſowed it at the diſtance of three inches one grain from another.

I uſed 2880 grains of wheat, weighing three ounces fifteen pennyweights, to ſow the three beds. In one of the beds of barley, I ſowed four rows. I employed 1491 grains, weighing two ounces, in ſowing the two beds; and four ounces of oats were ſufficient to ſow the two other beds. I neglected to count the grains.

Theſe ſeeds came up very well, and though they grew but little before winter, yet ſome of them ſhot out their ſecond leaf. They ſoon ſuſtained a conſiderable loſs. Numbers of ſmall ſnails eat many of the plants cloſe to the earth. I judged it neceſſary to ſupply this loſs, by ſowing freſh ſeed.

The winter was very unfavourable to corn. We had almoſt continual rains, with little ſnow or froſt. The corn in general ſuffered greatly, and the crops were very inconſiderable in this country.

Early in the ſpring, theſe plants made ſtrong ſhoots, and had much the better of the corn in the common way. The blades were very large, and of a deep green, and the number of ſtalks increaſed greatly. The alleys were hoed in good time, and the advantage reſulting from this operation, was very manifeſt. I viſited my plants the latter end of April, and found their numbers greatly diminiſhed. The miſchief which the ſnails had done them, was almoſt the only cauſe. The inclemency of the winter likewiſe deſtroyed ſome: ſo that I found I had loſt 1068 plants of wheat, and had but 1812 remaining. My plants of barley fell ſhort by 412, their number being reduced to 1079. The winter deſtroyed ſo many plants of the oats, that very few were left.

From this time, all the plants grew exceedingly: they branched ſo much, that, as far as I could judge, every plant of wheat, taking them one with another, produced 28 ſtalks, the barley above 40, and the oats ſtill more. Each plant formed a large tuft, ſome of 60, 80, and above a third part of the plants of about 150 ſtalks: ſo that though they were at firſt at a great diſtance from one another,

ther, in June and July they entirely covered the furface of the alleys. All thefe fpindled, and produced, each in its kind, very long and large ears, full of grain from one end to the other. They ripened kindly, but had not yet got over all their mifchances. Thefe fine ears were a prey to birds, which could not be kept off. This is an inconvenience to which all fmall experiments are liable. That I might fave fomething, I was obliged to cut my corn down before it was quite ripe. But before I did that, I examined myfelf as carefully as I poffibly could what the lofs might amount to which I had fuftained by the birds: and befides this, I fent for four farmers, (in quality of appraifers,) to eftimate the damage. They all agreed that it was above half the crop, and affured me I fhould not miftake if I reckoned it as fuch. I had formed the fame judgment myfelf. We found the lofs fomewhat lefs confiderable in the barley. As to the oats, it could not be fo well afcertained: but we believed it could not be lefs than a third part of the crop.

While the wheat ripened, I difcovered that fome plants were blighted. All thefe, whether blighted totally or only in part, I caufed to be plucked up, before I cut down the reft of the crop. They amounted to 297; fo that I was reduced to 1515 plants of wheat, the feed of which, after deducting that which produced the 297 blighted plants, is reduced to two ounces and fix pennyweights. The 1515 plants were the whole produce of the crop, which yielded 55 pounds of 18 ounces to the pound. But the fame ground and plants produced likewife what was eaten by the birds; for which it is but juft to make an allowance. The whole produce will then have been in reality 110 pounds, which to me feemed very confiderable.

I made another enquiry, which feemed to me of fome importance: this was, to know whether the number of the fineft and largeft ears, was greater than that of the middling and fmalleft. I examined them with the utmoft attention, and found almoft all the ears of equal beauty: at leaft 19 out of 20, I am confident, were fo.

I was likewife willing to know what number of grains might be contained in each ear. To this end, without regarding the proportion I had found between the number of the fineft ears and that of the fmalleft, I took twelve middle fized ears, twelve of the fmalleft, and twelve of the fineft.

The 12 middling ears contained one with another 37 grains.

The 12 fmalleft ears, 30 grains; and

The 12 fineft ears, 50 grains apiece.

The

The 1079 plants of barley, produced 75 pounds of 18 ounces to the pound. What was eaten by the birds, ſhould likewiſe be added here.

My oats produced 103 pounds of 18 ounces, excluſive of what was deſtroyed by the birds.

This little experiment ſhews that the new huſbandry will be equally profitable for all ſorts of grains.

OBSERVATIONS.

THE quantity of wheat gathered from the three beds, ſeems to me as great as could be expected. Though I had but 55 pounds, yet, adding thereto the 55 eaten by the birds, this little ſpot yielded 110 pounds. In large fields, we are not ſo ſenſible of what the birds deſtroy.

If we likewiſe take into this account, the 1068 plants deſtroyed by the ſnails, and the 297 blighted plants, making together 1365; they would have yielded 100 pounds of wheat, and the whole crop would have been 210 pounds: for it cannot be doubted but they would have yielded in the ſame proportion as the 1515. What proves it is, that in a ſpace about five fathom long, at the end of the beds, which eſcaped the ſnails, very few plants failed; and the reſt were very thriving and branched greatly: ſo that it is evident, the whole ground could eaſily have nouriſhed all the plants that were intended to grow on it, and which were at the diſtance of ſix inches from one another. I make this remark, in order to ſhew what may be expected from the following experiments, it being an eaſy matter to ſow the ground ſo as to have the deſired number of plants.

I ſuppoſe then, and I think juſtly, that this ſmall ſpot of ground can produce 210 pounds of wheat at one crop: but the ineſtimable advantages of the new huſbandry is, that it keeps the earth in a ſtate fit for ſowing every year; ſo that in two years it can yield 420 pounds; whereas in the common huſbandry of this country, the farmer can have but one crop in that time, being obliged to ſow his land only every ſecond year, and that one crop will fall greatly ſhort of the two which the new huſbandry will produce. A vaſt advantage in favour of this laſt.

Without being too partial to the new huſbandry, we may expect that the ſecond and following crops will be more plentiful, the earth being in finer tilth. Accordingly, the wheat with which I have ſowed theſe three beds a ſecond time, is already viſibly benefited by the looſer ſtate of the earth which has been ſo frequently ſtirred in the ſummer. I have provided againſt the accidents which deſtroyed ſo many of my plants, by ſowing thicker. Inſtead of three ounces fifteen pennyweights of wheat, which I ſowed laſt year, I have now ſowed nine ounces twelve pennyweights: and though the ſnails have again eat many of the plants this year, cloſe to the ground, a ſufficient number ſtill remains, by means of the additional ſeed, to fill the beds, and they are equally diſtributed.

I ſhall now compare the crop I have been ſpeaking of, with that of the experiment which I made on the ſame ſpot of ground in the year 1729, in order to ſee whether I could not obtain a more plentiful return, by ſowing thinner than is uſually practiſed. The ground was plowed and ſowed in the common way. I employed ſix pounds of wheat to ſow it, being ſomewhat leſs than half the uſual quantity. It looked extremely well all the time it grew, and produced above double the quantity that wheat did in the common fields. It yielded me 105 pounds of wheat. Even in this way, I could have but one crop in two years: and it appears that I have not exaggerated the produce of the new huſbandry, in making it 420 pounds in the ſame ſpace of time, which is a clear gain of 315 pounds.

I have ſince tried ſome other experiments; one of which, made in the year 1746, I muſt now mention. I tried two things at the ſame time: firſt, whether wheat would grow after it had been kept ſeveral years; and ſecondly, whether ſowing each grain at ſix inches diſtance would turn to account. As I did not intend to make the experiment on a large field, I choſe for it a ſpot of ſtrong earth, in bad condition, fit for making bricks. I ſowed in it three quarters of an ounce of wheat, which I had preſerved carefully for eight years. It roſe pretty well *; but about one fourth of the grains did not ſprout at all. After the winter, theſe plants grew very ſtrong. I delayed ſeeing them too long, for I found them quite choaked with weeds. I ſent a woman to weed them, who unluckily at the ſame time pulled up almoſt all the plants of wheat: the fineſt ſuffered moſt, ſhe not imagining that they could be wheat. There were but about

* M. Du Hamel obſerves, that it is very ſingular that wheat, eight years old, ſhould ſprout ſo well; for that he ſowed ſome of ſeven years old, which did not riſe at all.

about forty plants left, and thoſe at very great and unequal diſtances. Theſe produced tufts of upwards of fifty ſtalks, with ears five or ſix inches long, containing a great deal of grain, which became the prey of birds. This experiment, if it anſwered no other end, is at leaſt a proof of the goodneſs of the new huſbandry.

The good ſucceſs of theſe little experiments, was a ſtrong inducement to me to make more conſiderable ones: but in order to this, it was neceſſary to be provided with a proper hoe and drill-plough: for I muſt confeſs that Mr. Tull's did not appear to me to be ſuch. Its great fault is, that it is too complex.

Being provided with a proper hoe-plough, I ſoon became ſenſible of the advantages of it. Numbers of ſuch plows are already uſed in this country; and, which is ſaying a great deal, even our farmers make uſe of them.

This is the plough I uſed all this ſummer in preparing my grounds. It did admirably well in the alleys of my experiment, after the corn was above four feet high. No plant was hurt by it, and I could bring the plough as near them as I pleaſed. Thus it fully and conveniently performs this hoeing, in which I have ſeldom uſed more than one horſe. I have likewiſe prepared with it the ground ſowed with wheat this autumn.

My new horſe and drill-ploughs have made it eaſy for me to enlarge my experiments this year. However, I thought it moſt adviſeable to proceed by degrees; and have therefore limited myſelf to the culture of about eight arpents, according to the new huſbandry, part of which is in a very ſtrong ſoil, part in a very light ſoil, and part in a middling and ſtony ſoil.

What I have had chiefly in view in my experiments this year is *to know exactly what quantity of ſeed will produce the moſt plentiful crop.* To this end, I have ſowed wheat in different degrees of thickneſs, dropping the grains ſome at one inch, ſome at two, and ſo on, to the diſtance of ſix inches from each other.

All this wheat has at preſent a fine appearance, and the plants are infinitely ſtronger than thoſe in the common fields: their blades are much larger, and of a very deep green colour. What is more, they have already branched, and promiſe a great number of ſtalks. I have counted on ſome plants 20, and on others 25. Upon the whole, there is great reaſon to expect an abundant crop.

I have made another experiment with the drill-plough, with which I have ſowed ſome of my common fields. Inſtead of ſowing the feed by hand in the broad caſt way, as in the old huſbandry, I have ſowed the whole field with this inſtrument, without leaving any alleys. This has made a great ſaving of ſeed, having employed only twelve pounds of eighteen ounces, to ſow the ſame extent of ground, which uſed to be ſowed with 110 pounds. Yet I think this ſufficiently thick: the plants are very fine, and of a deep green. They have already begun to branch, and promiſe many ſtalks. Hitherto my wheat gives me reaſon to be pleaſed with the experiment I am making. I have ſowed about 25 arpents in this manner.

SECT. II.

Experiments made by M. Lullin de Chateau-vieux, *in the year* 1752.

MY experiments this year are of three kinds. The firſt was made on the ſame ſpot on which laſt year's experiment was made: the ſecond, on a piece of ground which was made into beds for the firſt time; and the third, on a field plowed in broad-lands in the common way, but ſowed with the drill plough, in equally diſtant rows, without any intermediate alleys.

Firſt EXPERIMENT. No. I.

I Have already mentioned, that this ſpot was ſowed with wheat, the beds being now made in the middle of the former alleys. The ſummer hoeings had brought this ground to ſo fine and looſe a ſtate, that, after one plowing, I ſowed the three beds with the drill-plough, the twenty-fifth of September; and to prevent the accidents I before met with, I increaſed the quantity of ſeed to nine ounces fifteen pennyweights.

The wheat roſe extremely well, and the rows were full of plants, which became very ſtrong and thriving before the winter. The ſnails deſtroyed a great number of the plants, as they had done the year before: yet, I judged the rows ſufficiently ſtored with plants, and thought that this accident would do no great damage to the crop.

The winter was pretty favourable to corn in general. My plants made very ſtrong ſhoots in the ſpring: but I found ſeveral little chaſms in the rows, which I had not perceived in the autumn. I imputed it in ſome meaſure to the inclemency of the winter, which had undoubtedly deſtroyed ſeveral weak plants. Theſe chaſms were

but

but few, and the worſt of them had about two plants in fifteen inches.

I horſe-hoed the alleys for the firſt time on the ninth of March, and a ſecond time the twenty-fifth of May. The ground was in ſo looſe a ſtate, that I thought it needleſs to hoe it afterwards, eſpecially as the wheat was in an exceeding good way. It continued of a very deep green till it ripened; the blades were extremely large; and the plants branched much more than they had done the year before. It was a common thing to find plants with between 60 and 70 ſtalks, which, in general, grew to above five feet and ſome inches high, and were crowned with large ears quite full of grain.

As ſoon as the wheat had done bloſſoming, I found it neceſſary to defend it againſt the birds. Thanks to the care that was taken, they did it leſs hurt this year than the laſt: but ſtill they eat a great deal of it, though I cannot preciſely determine the quantity.

As ſoon as the wheat appeared to be near ripe, in order to preſerve it from the farther plunder of thoſe robbers, I reaped it, on the twentieth of July, though I would rather have choſen to let it ſtand five or ſix days longer. It remained in the field four days, to dry, and was threſhed towards the latter end of Auguſt. It yielded an hundred and forty two pounds of wheat, at eighteen ounces to the pound.

This wheat was very fine, perfectly clean, and the grain much larger than in common.

This experiment gives juſt riſe to the following remarks.

Firſt; the earth of theſe three beds having been pulveriſed and brought to a very looſe ſtate by the horſe-hoeings in 1751, the plants were ſtronger and more thriving than thoſe of the year before; a circumſtance which contributed to the increaſe of the crop.

Secondly; this crop juſtifies my eſtimate, that this ſpot of ground could yield 210 pounds of wheat in one ſeaſon, if cultivated according to the principles of the new huſbandry: for if we add to the 142 pounds reaped this year, the loſs occaſioned by the birds and ſnails, it is pretty evident, that the whole produce would have nearly amounted to 210 pounds.

Luckily, that I might be more thoroughly ſatisfied what loſs I ſuffered by the birds, I counted in two differen: places how many ſtalks the plants in the three rows had yielded. On ten feet in length, I found 1600 in one place, and 2030 in another. As I would always avoid over-ſtraining my calculations, I ſhall only ſuppoſe that every

every ten feet in length produces 1600 ſtalks: the beds, being 160 feet long, will conſequently contain at leaſt 25600 ſtalks, and the three beds together 76800 ſtalks, or ears.

To know in the next place how many pounds of wheat might be contained in that number of ears, I had as many of them threſhed a month after harveſt, as yielded a pound of eighteen ounces. They were taken at random, without culling them, out of a ſheaf which ſeemed to have been but little damaged by the birds.

Three hundred and ſixty ears yielded thoſe eighteen ounces of wheat: ſo that, dividing 76800, the whole number of ears, by 360, the produce of the crop would be 213 pounds 6 ounces, at eighteen ounces to the pound, or 240 pounds of ſixteen ounces. Hence it appears, that my firſt eſtimate was pretty juſt, and that the produce may be even more conſiderable hereafter.

Thirdly; this ſpot was clear of weeds; though it uſed to be over-run with them. It appears by this, that the new huſbandry deſtroys them effectually; though this advantage will be leſs felt the firſt year, than in other ſubſequent years.

From the obſervation which I made, that the plants were in a more thriving ſtate this year, than in 1751; it follows, that the earth, far from having been exhauſted by the nouriſhment it had yielded the plants during that year, became more fruitful in this: which can be imputed only to the new culture, the land having received no other aſſiſtance, either by dung or manure.

The wheat was this year, upon a very exact ſearch, free from ſmut or blight. I found but one blighted ear, though there were numbers in fields contiguous to mine. I cannot however impute this favourable circumſtance to the new culture alone: it may have contributed thereto, and may leſſen the quantity: but to be ſure of that, requires ſome years experience.

EXPERIMENT. No. II.

THIS experiment was made on a larger field, in which three rows of wheat were ſown in each bed, the diſtance from the middle of one bed to the middle of the next, being ſix feet *. The whole extent of the field was 1650 ſquare toiſes or fathoms, each ſquare toiſe containing 36 feet.

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* M. Du Hamel thinks, that by means of the new horſe-hoe, the alleys may be made ſomewhat narrower.

The ſmall quantity of ſeed which I employed in ſowing it, certainly required that every grain ſhould grow: but the intended number of plants fell greatly ſhort, ſeveral of the grains not riſing at all, and many of thoſe which did riſe, being deſtroyed by inſects. The greateſt damage was done by ſnails. There were great chaſms in the rows, without any plants. As far as I could judge, between a third and a fourth part of the rows produced nothing; and yet the crop was pretty plentiful, as we ſhall ſee.

The hoeings were performed this year at proper ſeaſons, and rather the more frequently to make up for the neglect of the former year: for the ground was not in ſufficiently fine tilth when the wheat was ſowed.

On the fourteenth and fifteenth of October 1751, the alleys were plowed for the firſt time before winter.

The ninth and tenth of March 1752, they were plowed again for the firſt time after winter.

From the eighteenth to the twenty-fourth of April, the ground was weeded.

The twenty-ninth of April, the alleys were horſe-hoed; which was again repeated, the twenty-fifth of May and the ſeventh of June.

This wheat made a fine appearance: the length of the ſtalks, and the largeneſs of the ears, ſhew'd how much the new culture promoted the growth of theſe plants, which branched nearly as much as thoſe of No. I. This field was reaped the twenty-fifth of July.

I ſhall join to the account of what this crop produced, an eſtimate of what might have been expected if the ſame ground had been cultivated in the common way.

A compariſon of the produce of the ſame field, cultivated according to the old, and according to the new huſbandry.

THIS field, which is of a very good and ſtrong ſoil, was very badly plowed laſt year, by reaſon of the frequent and heavy rains, and had not been dunged for ſeveral years. In the common way, it uſed to be ſowed with 318 pounds of wheat. This year, it was made into beds of ſix feet wide, and ſowed the twenty-fifth of September with 10 pounds of wheat.

Pro-

Produce of this field under the new culture in 1752.

This field, laid out in beds, produced, of very fine large grain'd wheat,		926 lb.

To be deducted.

Tho' this wheat was very clean, yet four parts in an hundred were ſifted from it, as ſmall corn; valued at	37 lb.	47 lb.
For the ſeed ſown	10 lb.	
Neat produce		879 lb.

In this huſbandry, the ſame field is ſowed every year; ſo that ſuppoſing the crop of 1753 to be only equal to this of 1752, (and there is no doubt but it will be greater) it will again produce	879 lb.
Amount of the two crops	1758 lb.

Produce of the old culture.

If we judge of it by the beſt crops of former years, it will be three times the quantity of the ſeed, *viz.*		954 lb.

To be deducted.

Loſs by ſifting, 15 *per cent.* It has often been 25 and 30 *per cent.* and even more. Every time this field was ſowed, the corn was lodged, which prevented the ears from filling, and rendered the grains ſmall and ſhrivelled	143 lb.	461 lb.
For the ſeed	318 lb.	
Neat produce		493 lb.
Conſequently the balance, in favour of the new huſbandry, is		386 lb.
		879 lb.

As

As this field yields but one crop in two years, in the common huſbandry, it would produce in that ſpace, only	493 lb.
From whence it follows, that the neat profit of the new culture in the ſame ſpace of time, exceeds the other by	1265 lb.
	1758 lb.

Suppoſing this field never to produce a greater crop than that of this year, it is evident that it is beſt to follow the new method. But we can already promiſe, that the ſucceeding crops will be more plentiful. The field is now ſowed in the new way; it has not yet ſuffered any damage by inſects; the rows are well ſtored with plants, whoſe more thriving ſtate promiſes a better crop than laſt year's.

It may perhaps be thought odd, that I ſhould limit the produce of the field ſowed in the common way, to three times the ſeed. I know there are lands in this country which yield more, *viz.* four or five times the ſeed, and ſometimes upwards: but then it muſt be granted, that there are but few ſuch lands; and that they are fields in extraordinary fine tilth, and enriched with manure. I therefore ſpeak of our lands in general, taking good and bad together. In this caſe, I ſay, the produce, one year with another, will not exceed three for one.

My fields have always been as well cultivated as any in the country. I have computed the amount of my crops for ſixteen years running, *viz.* from 1730 to 1745, incluſively. Theſe accounts were carefully kept by a ſteward who died a few years ago, and I do not find that the produce ever was greater than what I have been ſaying, one year with another.

EXPERIMENT, No. III.

I Cauſed a ſpace of about 1344 ſquare toiſes of 36 feet, in another field, to be laid out in beds like the former. This land, which is very ſtrong, was but in bad tilth, notwithſtanding the care I took to break the earth thoroughly, and reduce it into ſmall particles. The frequent rains were the cauſe of this. It was ſowed with the drill-plough the twenty-fourth of September. Only ſeven pounds of wheat were uſed. The plants roſe pretty well: but, towards the end of autumn, they were deftroyed daily by infects, and thereby reduced to a very fmall number, which greatly diminifhed the crop.

The fixteenth of October 1751, the alleys were plowed for the firft time before winter.

The tenth and eleventh of March 1752, they received their firft plowing after winter.

The firft of May, the ground was weeded.

The twenty-third of May, the fecond plowing after winter was performed with the horfe-hoe; which was repeated the twelfth of June.

The plants which came up were very fine, and branched greatly: the ears were like thofe of the experiments I have already mentioned, and the grain equally large. Tho' the produce was but 392 pounds, yet it is a fine crop for the fmall number of plants that efcaped unhurt.

As I know the caufes to which the fcantinefs of this crop was owing, I make no doubt but it will equal that of any of the other fields next year. It is now fowed, for the fecond time, in the new way. The rows are well ftored with plants, and the corn is in as good condition as I could wifh.

EXPERIMENT. No. IV.

THIS experiment was made at the diftance of fix miles from my houfe, on a light poor foil, which induced me to dung it.* The beds were about fix feet wide, and were fowed the twenty-firft of September with three pounds and three quarters of wheat, which produced fine plants and large ears, and yielded 196 pounds. Tho' the earth had not been well ftirred, nor at proper feafons; yet the corn fowed in it, produced greatly. The dung undoubtedly helped to make up for the want of due culture.

* M. Du Hamel obferves, that tho' dung may generally be fpared in the new hufbandry; yet it certainly is of confiderable ufe, efpecially in poor lands.

EX-

EXPERIMENTS

Made on fields ſown in equally diſtant rows, with the drill-plough.

No. V.

I Have ſowed fields cultivated in every reſpect in the common way, except in the manner of diſtributing the ſeed, which was done with the drill-plough. The whole field was covered with rows of wheat, diſtant from each other ſeven inches and an half.*

The advantages which I propoſed to myſelf by ſowing in this manner, were, firſt, the ſaving of ſeed and preventing the earth from being over-ſtocked with plants: ſecondly, burying the ſeed at a proper depth: thirdly, having the plants at equal diſtances: and laſtly, the little ſtirring of the ground and breaking of the clods, which the drill-plough effects at the ſame time that it ſows. Theſe things ſeemed to me more likely to be attended with ſucceſs, than the common way of ſowing.

The plants of this wheat were very fine: their deep green colour ſhewed their ſtrength: the largeneſs of their blades, and the number of their ſtalks, ſhewed likewiſe that they found greater plenty of nouriſhment than wheat in the common way. The plants had, in general, four, ſix, eight, ten, or more ſtalks; ſo that theſe fields, which, till the month of April, ſeemed ſcarcely to have been ſown, changed then ſo as hardly to be known again, by the number of ſtalks which ſhot forth at that time. The wheat was taller than that in the old way, and the ears larger and better filled with grain.

An account of the produce will ſhew what may be expected from this manner of ſowing.

Account of the produce of the ſame field ſowed part in the old way, and part with the drill-plough, the fourteenth, fifteenth, and ſixteenth of September 1751.

THE whole of this field uſed commonly to be ſowed with twenty meaſures of wheat, each meaſure containing 106 pounds of 18 ounces. Three meaſures, or 318 pounds of wheat,

were

* M. de Chateau-vieux calls this method of ſowing, *ſemer en plein, to ſow in full.* We ſhall expreſs it by, *ſowing in equally diſtant rows,* in oppoſition to fields laid out in beds and alleys.

were ſown in the uſual way in the richeſt part of the field. The remaining part was ſowed with the drill-plough, with only 265 pounds of wheat, which in the common way would have required 1802 pounds.

The ſoil was middling, neither too ſtrong nor too light, and pretty ſtony. The land was poor, becauſe it had not been dunged; which indeed it ſeldom was, the owner not having more than was neceſſary for his vines.

Produce of the new huſbandry.

The 265 pounds of wheat produced . . .		5450lb.

To be deducted.

For ſmall and bad grain ſifted out, 4 *per cent.* .	218	483lb.
For the ſeed	265	
Neat produce . .		4967lb.

If the other part of the field, which was ſowed with the three meaſures in the old way, had been ſown with the drill-plough, it would have yielded	960lb.

To be deducted.

Loſs by ſifting, 4 *per cent.* . . .	38lb.	84lb.
For the ſeed	46lb.	
Neat produce to be added to the above . .		876lb.
Neat produce of the whole . .		5843lb.

Produce of the old huſbandry.

That part of the field which was ſowed with the three meaſures of 106 pounds each, produced thrice the quantity of the ſeed, mixed with bad grain. The ſame meaſure of this grain weighed but 103 pounds. This field yields no more even in the beſt years. If the whole

whole of it had been sowed in the old way, it would have produced . . . . . 6180lb.

To be deducted.

Loss by sifting, 15 *per cent.* It has often been 25lb. and 30 *per cent.* . .	927lb.	3047lb.
For the seed	2120lb.	
Neat produce . . .		3133lb.
Ballance in favour of the new method . .		2710lb.
		5843lb.

EXPERIMENT, No. VI.

I Sowed another field of about 1020 square toises of 36 feet, in the same manner, with thirty pounds of wheat, reckoning 18 ounces to the pound, on the twenty-fourth of September. The soil was strong, and in fine tilth. The wheat grew in every respect like that of the preceding article, with this only perceptible difference, that the straw was somewhat longer, and the ears larger. It was not threshed till the beginning of December, and yielded 809 pounds of very fine wheat (the pound 18 ounces). The produce of this field was greater than that of the former, in proportion to the quantity of seed. But the soil of this was better, and in finer tilth.

EXPERIMENT, No. VII.

THIS experiment was made about three miles from me, on a piece of ground of the extent of about 880 square toises. This land is neither too strong, nor too light, and may be called a pretty rich soil. It was plowed three times, like other lands, and had not been dunged for many years. It used to be sowed with 165 or 170 pounds of wheat. It was now sowed on the 5th of October, with only 24 pounds. Tho' the season was so far advanced, this seed came up pretty well before winter. The plants throve greatly in the spring, and the field became covered with strong stalks, and very large ears, full of fine plump grain.

The crop yielded 800 pounds of clean wheat, without mixture of any other seeds. Deducting from this the 24 pounds of seed, the neat

neat produce is 776 pounds. This field, ſowed in the common way, produces, in the beſt years, about 875 pounds: from which if we deduct 165 pounds for the ſeed, the neat produce will be 710 pounds. Thus we ſee that the ſame ground ſowed with the drill plough, produced 66 pounds more than when ſown in the common way. But as wheat raiſed in this laſt way is always mixed with abundance of ſeeds of weeds, which muſt be ſeparated by ſifting, an allowance muſt likewiſe be made for that; and the profit will then not be limited to the 66 pounds only, which the owner reaped more than in the common way.

I omit ſeveral experiments of wheat ſowed in beds, and with the drill-plough, in equally diſtant rows, the ſucceſs of which has been nearly equal to that of thoſe I have already ſpoken of. I ſhall mention only one more, and that, on account of a circumſtance which deſerves to be known. I made it on a light ſoil, the worſt I knew of, full of pretty large ſtones, and which had not been dunged in the memory of man. The ſtones did not hinder the drill-plough from dropping the ſeeds very regularly. I choſe this bad ſoil, on purpoſe to ſee how the corn would thrive in it. I allowed too little ſeed, conſidering the badneſs of the ſoil. The ſtones prevented many plants from riſing, and many more were deſtroyed by inſects; ſo that the wheat was very thin, and the crop ſmall. I was, however, pleaſed with it, becauſe I found the plants grew almoſt as ſtrong as in a good ſoil, and the ears were as large, and as full of grain.

A little before harveſt, the wheat of all theſe experiments ſuſtained many heavy rains, accompanied with very high winds; and though the ſtraw was much longer than that of the wheat which had been ſowed in the common way, the corn was not lodged: whilſt a great deal was in the neighbouring fields. Some indeed was bent; but that is different from being *lodged*. This laſt is very hurtful to the filling of the grain,; but its being *bent* is attended with no inconveniency*. I am even inclined to think that it may be of ſervice to the wheat, not to remain in a perpendicular direction; and intend next year to be particularly attentive to this.

It is not at all to be wondered at, that plants ſown in the common way, ſhould not thrive as well as thoſe which grow in beds. The firſt not having been aſſiſted by the ſtirring of the mould, cannot

* We were therefore right, ſays Mr. Du Hamel, in obſerving, that corn would be leſs liable to be lodged in following our method, than in proceeding in the common way.

draw

draw ſo much nouriſhment from the earth, as thoſe in beds. The ſize of theſe laſt has indeed exceeded my expectation. There is reaſon to be ſatisfied with this manner of ſowing, even if it were attended with no greater advantage than this year's crops afforded. But if the quantity of ſeed is increaſed, ſo that the field be ſtocked with as many plants as it can nouriſh, the profit will be ſo much the more conſiderable.

It is time to retnrn to our experiments on fields laid out in beds, which are the more immediate object of the new huſbandry.

Thoſe which I have made this year, have not brought the produce of the new culture to near what it will be hereafter; as will appear from what I ſhall next obſerve.

Reflections of M. de Chateau-vieux, *which prove the truth of the principles on which the new huſbandry is founded.*

WE ſee by the experiment, No. I. that the earth, being in a looſer or more divided ſtate the ſecond year, is better able to afford a greater quantity of nouriſhment to plants, whoſe productions will always be proportioned ro the eaſe with which they can reach that nouriſhment.

I was in hopes that the experiments of this year would have enabled me to determine what quantity of ſeed it is beſt to ſow, in order to obtain the greateſt crop. The lands on which I ſowed the moſt ſeed laſt year, ſhewed me plainly, that it would be right to increaſe the quantity, in order to provide againſt the accidents by which the plants had been thinned too much.

But this increaſe of ſeed ſhould be regulated with great diſcretion, regard being had both to the circumſtances of the ſeaſon in which the ſeed is ſowed, and to the condition of the ground in which it is planted. If the ſoil is in very fine tilth, leſs ſeed will be ſufficient.

The experiments of this year ſhew that there are but three principal means by which we can obtain the utmoſt production that plants are capable of affording. Theſe means are practicable only in the new huſbandry: for in that alone each bed has the number of plants which it can properly nouriſh; which is the ſource of plenty.

The firſt means is, to make the plants produce a great number of ſtalks.

The ſecond is, to make each ſtalk bear a large ear.

The third is, to make each ear be quite full of plump grain.

Theſe

Theſe effects cannot be obtained in the old huſbandry, becauſe they can only be procured by frequently ſtirring the earth.

All my experiments this year, ſhew the truth of this: but eſpecially the experiments No. I. and II.

It is therefore by horſe-hoeing the alleys whilſt the plants are yet young and growing, that we can *make them produce a number of ſtalks, cauſe thoſe ſtalks to bear large ears, and fill each ear with large plump grain.* But to obtain theſe advantages, it is of great conſequence that the hoeings be performed at proper ſeaſons, each having its peculiar effects.

The plowing before winter, *is intended to drain off the water*, which if it ſhould remain long near the plants, would chill and greatly hurt them, *and to lay up the earth to be mouldered by the winter's froſt.* It is hereby enabled the better to ſupply the plants with their neceſſary food in the ſpring. This may be done at the farmer's conveniency, from the time that the plants have three or four blades, till the froſt ſets in: and even in the winter, if it does not freeze, plowing will always be of ſervice.

The firſt plowing after winter, is of great importance. *'Tis to this that we owe the number of ſtalks which the plants produce.* That it may have this effect, it muſt be performed as ſoon as the ſevere colds are paſt; and, at lateſt, as ſoon as the plants begin to ſhoot. If it is delayed longer, it will contribute very little towards their branching. It will ſerve only to make the ſtalks grow longer. If any new ones ſhoot out, they will not thrive ſo well as the firſt; and therefore it is of great conſequence that they ſhoot out all together.

The hoeings that are performed from this time, till the wheat has done bloſſoming, *ſtrengthen the plants, lengthen the ſtalks, and enlarge the ears.* The ſeaſon of theſe hoeings is not ſo exactly limited as that of the former, and the frequency of them will depend greatly on the ſtate of the ground: for it muſt not be touched when it is too moiſt. If the ſeaſon is kindly, they may be repeated two, three, or four times: but I think one hoeing highly neceſſary juſt before the ears break forth. They certainly grow longer and larger by it.

The laſt hoeing is the moſt important of all, and that which can leaſt be diſpenſed with. It muſt be performed as ſoon as the bloſſom is gone off the wheat. *This fills the whole ear, and ſwells the grain.*

When farmers become ſenſible of the good effects of theſe frequent ſtirrings, they will not neglect to repeat them at the proper ſeaſons. It is by a ſucceſſion of them, that, in my opinion, crops can be brought

brought to their higheſt perfection: and if unfavourable ſeaſons prevent their being done at their proper times, a diminution of the crop will moſt aſſuredly follow.

No one who conſiders the produce of the ears of corn on lands cultivated according to the new, and the old huſbandry, will, I believe, doubt which of theſe is to be preferred. I ſhall beſtow a few moments, to point out the difference which I have found between the one and the other.

I ſaid before, that 360 ears yielded me 18 ounces of wheat. Here is a determined fact; and I am certain that I have not enlarged it; becauſe the birds had eat ſome of the grain: otherwiſe fewer ears would have produced thoſe 18 ounces.

When, in the year 1750, I firſt began to inquire into the principles of the new huſbandry, I judged it might be of ſome importance to come at the knowledge of what the uſual produce of a plant of wheat is, when cultivated in the common way. That year was reckoned a very good one for wheat, which appeared clean and good as it ſtood upon the ground. I took this method to come at the knowledge I wanted.

I took part of a ſheaf which appeared to me very good, and which was the produce of a very rich field. I divided it into three parcels. In the firſt parcel were all the good ears; the middling and ſmall ears were in the ſecond, and the ears in which there was no grain, or where the grain was faulty, compoſed the third.

The wheat being thus divided, I counted the number of ears in each parcel. I found 400 in the firſt, which conſiſted of the beſt ears; 1600 in the ſecond, which contained the middling and ſmalleſt ears; and in the third, 750 ears, or plants whoſe grain was faulty. I made no account of a great number of imperfect ſhoots which were not ſix inches long.

The fields did not look ſo poor to the eye, as this ſeparation proved them to be. This firſt operation was therefore neceſſary to come at the truth.

On clearing the grain from the ears, I found that the 400 ears contained five ounces and a half of wheat, and that the 1600 contained ſeven ounces.

My curioſity did not lead me to inquire into the contents of the third parcel; knowing that there was no good grain in it.

In the purſuit of this inquiry, I found that taking one ear with another, of the 400, there were but *eleven grains of wheat in each*;

 and

and that in the 1600, taking one ear with another, there were but *three grains and an half* to an ear. Eight hundred of theſe grains weighed but an ounce.

If we add theſe parcels together, we ſhall find that 2000 ears yielded but 12 ounces and an half of wheat, and that it would require 2890 ears of the ſame goodneſs to yield eighteen ounces.

I confeſs I was aſtoniſhed at the reſult of my inquiry; which I could not have believed, had I not ſeen it. But at the ſame time, how greatly was my expectation raiſed of the advantages of the new culture!

I have this year formed a greater extent of ground into beds. The too frequent rains have prevented my laying down more than 25 arpents in this manner: but I have ſowed all the reſt of my farm with the drill-plough in equally diſtant rows. I have increaſed the quantity of ſeed; regard being had to each circumſtance neceſſary to be attended to; ſo that in ſome fields I have ſowed double the quantity of ſeed that was employed in the year 1751; in others ſomewhat more, and in others again leſs.

All my fields look extremely well, and make a much better appearance than they did laſt year. They are abundantly ſtocked with very ſtrong plants, of a deep green colour: the blades are long and large, and cover the earth better than the common wheat.

Hitherto, theſe plants have ſuſtained no loſs, except in one ſpot of about half an arpent, where the plants were gnawed aſunder, juſt under the ſurface of the earth, by inſects. I immediately ſowed it again, and by this means have quite made up the loſs. The inſects have not appeared ſince.

One of the moſt happy effects of my experiments, is, that they have created a deſire in many perſons in theſe parts, to begin the practice of the new huſbandry, by trials of conſiderable extent. One perſon, convinced of its excellency, has laid out and ſowed at leaſt twenty-three arpents in beds: another has ſowed with the drill-plough, an hundred and twenty-five arpents plowed in broad lands. All the land that has been ſowed in beds amounts to about fifty arpents; and about two hundred arpents in broad lands have been ſown with the drill-plough. Every one who has ſeen theſe grounds, even the very plowmen not excepted, agree that they look extremely well, and that they never ſaw in this country plants of ſuch ſtrength and vigour, as the wheat that was firſt ſown.

I am extremely happy that my drill-plough has been of ſo general uſe.

uſe. It has every where done its buſineſs very regularly, people having ſowed with it the exact quantity of grain they have deſired.

SECT. III.

Experiments made by M. Lullin de Chateau-vieux, *in the year* 1753.

I Am the better pleaſed that I am able to give a ſatisfactory account of the ſucceſs of my experiments this year, as the ſeaſons have not been favourable, and extraordinary accidents have greatly diminiſhed the produce of the crops.

I ſhall divide this account into ſeveral articles.

The firſt will contain the experiments made on lands laid out in beds, which have born their ſecond and third crop. To this will be added ſome obſervations relating thereto.

The ſubject of the ſecond will be a detail of experiments made on lands formed into beds, which have yielded only their firſt crop. This too will be followed by ſome remarks.

The third will conſiſt of the experiments of two perſons, on lands made into beds, of which the firſt crop was reaped this year: to which will be ſubjoined ſome neceſſary reflections.

The fourth article will contain an account of ſeveral experiments made by divers lovers of Agriculture, on lands ſown in equally diſtant rows, but with the drill-plough.

As we think it will be extremely uſeful to ſhew, by the experiments which have been made this year, that lands produce more corn by the new huſbandry, than by the old; we ſhall give an account, in the fifth article, of the crops of fields ſown in the common way for ſixteen years together; and of thoſe of the ſame fields cultivated according to the new huſbandry, ſuppoſing them not to yield better crops in future years, than they have done in this:- a ſuppoſition the leaſt favourable that can be to the new culture, ſince we calculate only upon the produce of the firſt year's crop, and that too diminiſhed by the extraordinary accidents which we ſhall mention.

To ſhew the truth of this article more fully, it will be proved in the ſixth, that the beſt field in the country, though it had been well dunged, yielded leſs wheat than thoſe on which the experiments were made, and on which no dung was uſed.

The ſeventh article will conſiſt of reflections and obſervations on our practice of the new husbandry; and the eighth will shew the disposition of our lands for the crop in 1754.

To avoid repetitions, we shall observe here, once for all, that no dung or other manure was used in any of our fields; that the extent of all our fields is computed by square toises, of thirty six square feet to the toise, and that our pound consists of sixteen ounces.

ARTICLE I.

Experiments made on lands laid out in beds, which had born a second and third crop, with some observations particularly relating thereto.

EXPERIMENT, No. I.

N. B. *This experiment is marked with the same number in the year* 1752. (p. 148.)

I Should have known the full produce of this third successive crop on the beds of this field, if the hail which fell on the third of June had not damaged it greatly. The abundance of rain which fell at the same time, and immediately after the hail, did still greater hurt; for the earth of part of the beds was washed away by the torrents of water, some of the plants were forced out of their places, others were entirely covered with earth, and many were torn up by the roots; so that it was not possible to judge what this year's produce would have been, by the few plants that were left.

I am very sorry that this accident deprived me of a certain proof, that this year's crop would have been more plentiful than that of 1752: for it would have been evident, that the earth becomes more and more fruitful by the new husbandry: a truth, which it is of consequence to establish. I can therefore only affirm by conjecture, that this crop would have been greater. It is true, my conjectures are so strong, that they amount almost to a demonstration.

I draw them from hence: that the corn had a very fine appearance before winter; that the plants grew with great force in the spring; that they branched more than formerly; that the ears were certainly larger; that they blossomed extremely well; (they were in full bloom the thirtieth of May;) and lastly, that there is more straw than in 1752.

It necessarily follows from hence, that had it not been for the hail and torrents of water; the crop would have been greater than in 1752.

Though the following experiment suffered the ſame accidents, (except that the beds were not broke up by the water,) it will ſupply the want of that information which we were deprived of in the other, and ſtrengthen our conjectures.

EXPERIMENT, No. II.

N. B. *This experiment is marked with the ſame number in the year* 1752. (p. 150.)

AS I hope this experiment will be found very inſtructive, I ſhall relate it with the ſame care that I executed it. I therefore beg it may be particularly attended to; for it will confirm the advantages of the new huſbandry. But before I enter into a detail, of which I ſhall endeavour not to omit any eſſential circumſtance, it is neceſſary to repeat here, that in the journal of 1751, I ſaid, 1. That the plowings which had been given the earth in order to its being ſown in 1752, had not looſened it ſufficiently, and that I tried to remedy this defect by ſubſequent culture. 2. That this field was ſowed the twenty fifth of September with eleven pounds and four ounces of wheat. 3. That the crop yielded a thouſand and forty two pounds twelve ounces: and laſtly, that the appearance of the young plants promiſed a much greater crop in 1753.

The culture beſtowed upon theſe lands in 1752, rendered them more and more looſe and well divided, ſo that with only one plowing after harveſt, which was performed with the utmoſt eaſe, I formed new beds, the ridge of which was now in the place where the furrow in the middle of the alley was before. But the earth was deeper ſtirred and made much looſer than in 1752. I had already attained almoſt a perfect tilth, and eaſily foreſaw that I might quite complete it in 1753.

Whilſt I laboured aſſiduouſly in the culture of wheat, from which I would not ſuffer any thing to divert my attention too much, till I ſhould arrrive at a good and certain practice of the new huſbandry: I nevertheleſs determined to begin experiments on luſerne and ſainfoin, to cultivate them nearly in the ſame manner as wheat. What prompted me to this, was the ſucceſs of a ſmall experiment the year before. Accordingly, taking this object likewiſe into ſerious conſideration, I reſolved to leave a part of this field for luſerne, and to ſow the

the reſt with wheat. It contained in all 1650 ſquare toiſes, formed into 45 beds. I left for the luſerne, nine beds, the extent of which was 303 ſquare toiſes; and deſtined the ſurplus to be ſowed with wheat, as before. I am now very attentive to the experiments on luſerne and ſain-foin, and ſhall begin next year to give an account of them, and of my manner of proceding. My practice in this, will be found different, in many reſpects, from the method which is commonly purſued. I will venture to affirm that there will be room to be ſatisfied with the ſucceſs of this branch of huſbandry, than which none can be more intereſting: plenty of fodder being as neceſſary as plenty of corn.

I muſt therefore beg leave to give the produce of this field, as if the whole of it had been ſowed with wheat. This I do, in order to compare the produce of 1753, with that of 1752; as it cannot be doubted but that the nine beds now under luſerne, would each of them have yielded as much wheat, as any of the beds did that were ſown with it: nay, perhaps ſome pounds more: the luſerne being ſown in what I thought the richeſt part of the field. This field was ſowed the firſt of September. I increaſed the quantity of ſeed, ſowing this time thirty four pounds fourteen ounces of wheat; whereas in 1751, I ſowed but eleven pounds four ounces. Though I ſowed this year more than thrice the weight of ſeed that I did in 1751, it muſt not be inferred that I tripled the number of grains capable of producing plants; becauſe this year's ſowing was made with wheat of the produce of the new culture, the grains of which are much larger than thoſe of the common wheat which I uſed in 1751, and of which a greater number is conſequently required to make up an equal weight.

This wheat having been ſown pretty early, its plants had time to grow very ſtrong before winter, the cold of which they bore very well: and the plowing I gave them the fifteenth of October, by cutting a very deep furrow within about three inches of the rows, ſecured them from the damage which corn frequently ſuffers from rain or the melting of the ſnow.

In the ſpring, they made ſtrong ſhoots, grew apace, and branched very abundantly. I aſſiſted them, as I am going to relate, at proper ſeaſons, both with reſpect to the condition of the plants and earth, and to the temperature of the weather.

The fifteenth of March 1753, I gave them the firſt plowing after winter.

The twenty-ſixth, the beds were weeded.

The

The eleventh of April, I horſe-hoed them.

The twenty-ſixth, the thiſtles were plucked up.

The fourteenth of May, the hoeing was repeated.

The fifteenth, the ears began to appear.

The twenty-ninth, the fourth culture was given with the cultivator.

The thirtieth, the wheat was in full bloom.

The third of June, the wheat ſuſtained a violent ſtorm of hail and rain.

The thirteenth, the fifth culture was given with the new plough with two ſhares.

I beg leave to obſerve, that there needs no better proof that wheat, cultivated according to the new huſbandry, will be little apt to be lodged, than the eaſe with which I performed the fifth culture, after the accidents which happened the third of June, when the wheat had attained its greateſt height. So far was it from being laid thereby, that the whole extent of the plough found free admittance into the alleys, and this laſt culture could be given without damaging the ſtalks.

Though the whole of our plowing and hoeing may be performed extremely well with my plough and the inſtrument which I call the *cultivator*, yet I have thought of making this taſk ſtill more eaſy. Two new inſtruments, (not indeed abſolutely neceſſary,) will anſwer this end. I propoſe them only as very uſeful, and proper to be employed only the ſecond or third year, when the earth has acquired part of that minute diviſion, of which it is ſuſceptible.

The cultivator with mould-boards, and the plough with two ſhares, are two inſtruments which I have invented this year. I have found them extremely uſeful to give the two laſt ſtirrings, better, and in leſs time than our other inſtruments. The reader may not be diſpleaſed to know what firſt ſet me upon contriving them.

One cannot enter properly into the ſpirit of the new huſbandry, without being thoroughly convinced that the earth cannot be too minutely divided : I will even ſay, till it is reduced to a perfect powder : and that when one has been ſo happy as to attain this point, it muſt be kept in that ſtate. This will always be done beſt, by uſing the moſt proper inſtruments.

I obſerved one day, whilſt I was hoeing my wheat, my plough being then at work, and the earth in a very looſe ſtate, that every time the alleys were ſtirred, they were thrown into a different form :

for

for it is neceſſary ſometimes to make a deep furrow in the middle of the alleys, and at other times to raiſe a ridge in them; and yet, in whatever form the alleys were, I had only my plough to perform theſe different operations. It did not ſeem to me reaſonable to ſuppoſe, that two ſo different works could be done equally well with one and the ſame inſtrument: whence I concluded that it was neceſſary to have an inſtrument for each of theſe purpoſes.

I ſoon found what I wanted. The cultivator with mould-boards opens a large furrow in the middle of the alley, by turning over the earth at the ſame time to both ſides. The plough with two ſhares, on the contrary, at the ſame time takes up the earth on both ſides, and turns it into the furrow, which it fills, and thereby lays the foundation of a new bed.

Theſe inſtruments have this farther advantage, that, without requiring a greater number of oxen or horſes, they perform as much work at once going over the ground, as the plough can do in two, and ſometimes three operations. I return to my experiment.

The twenty-third of June, the wheat ſuſtained a violent hurricane, which laſted an hour. Several great pear-trees were blown down in my orchards, and many large branches were broke off from other trees.

The eighth of July, a ſcorching wind blew, which ſhed a great deal of the ripe corn.

The ninth, the wheat was reaped.

A month after harveſt, it was threſhed.

This field yielded 1575 pounds of wheat; deducting from which the 34 pounds 14 ounces uſed for ſeed, the neat produce remaining is 1540 pounds two ounces. Conſequently, in 1753, this field produced 533 pounds four ounces more than in 1752, including what was ſaved in the ſeed.

The grain of this wheat was very large, and ſo clean, that it did not want ſifting. It yielded plenty of very fine flour, which made exceeding white and well taſted bread.

EXPERIMENT, No. III.

N. B. *This field is marked with the ſame number in the year* 1752. (p. 153.)

THIS field contains 1344 toiſes, and was but in poor tilth. It was ſown the twenty-fourth of September 1751, with ſeven pounds 14 ounces of wheat, and yielded 441 pounds.

It was brought into better tilth in 1752, but the beds were not raiſed high enough: I would have given them another plowing, had not the rainy ſeaſon prevented me. They were ſown the eighth of September, with 24 pounds 12 ounces of very large grained wheat. The plants were very fine before winter, and the rows well filled. In ſpring, I found that there were fewer plants than in autumn: the inſects had deſtroyed ſeveral of them. I likewiſe imputed the loſs of many to the flatneſs of the beds. The plants acquired freſh vigour after the winter, made ſtrong ſhoots, and branched extremely well. I treated this field in the ſame manner as the former. The plants made nearly the ſame progreſs. They were reaped the fourteenth of July, and yielded 724 pounds 8 ounces. Thus we ſee that this field yielded 283 pounds 8 ounces more in 1753, than in 1752.

Obſervations on theſe experiments.

I Obſerved in my former experiments, that as the mould was not ſufficiently looſened, the fields, which were laid out in beds could not produce ſo plentiful a crop the firſt year, as they would the ſecond or third year, when the earth ſhould be more thoroughly divided. It is evident, that whoever ſhould have given up the new huſbandry, on the bad ſucceſs of the firſt year, would have deceived himſelf. Theſe experiments plainly ſhew, that the charge of the firſt year is fully recompenſed by the profit of the ſecond, and that this profit will increaſe from year to year.

Whoever now tries the new huſbandry, may reaſonably expect better crops than mine, even the firſt year; becauſe, 1. They now know the preparations which the earth requires: 2. They may be provided with inſtruments, already experienced to anſwer their purpoſe with conveniency and eaſe. The different circumſtances to be attended to, are likewiſe known. From the knowledge I have acquired in these matters, I can promise that the present appearance of the corn, which I have sowed this year in beds, promises a very great crop next season. I shall likewise have occasion, in the course of these observations, to shew, that though the first crop may seem very small, yet it is in fact more profitable than that of lands cultivated in the common way.

Let us now proceed to the present state of the lands cultivated for two years according to the new husbandry, and observe what the effects have already been.

When the corn was sowed, the beds were in a much looser state than before, and the grain consequently covered with a fine mould. It came up better: the roots more easily extended themselves, and increased in number, in a soil which scarce resisted them: the plants were stronger, and better able to bear the severity of the winter; and by a small increase of the seed, the earth was better filled with plants, and thereby better able to sustain the accidents which had thinned them before. After the winter frosts were over, the mould was in so loose a state, that it looked as if it had been newly plowed: a very different state from that of land in the common husbandry, which is at this season hard, compact, and very little fitted to afford an easy passage to the tender roots of plants. How easy too did this render all the subsequent culture! The weeds, already greatly diminished, did little damage to the corn; and we may readily conceive that the earth, in this loose state, was easily penetrated by the rains, dews, and moisture of the atmosphere.

The effects were, that the plants grew stronger and taller than before; that they branched into a greater number of stalks; that the ears were very large and well filled with grain, if we may judge by those which escaped the hail; that the wheat was very clean; and lastly, that the crop was greater than that of the preceding year, though it had been greatly diminished by the hail, the hurricane, and the scorching wind which made many of the ears shed their corn. I tried every possible means of ascertaining the loss occasioned by these accidents; but in vain. I have therefore given up an uncertain calculation; and all I can say, is, that I am sure the loss was very considerable.

ARTICLE II.

Experiments made on lands which had borne a firſt crop. Remarks on theſe experiments.

WE did not expect that the fields we are now going to ſpeak of, would yield a crop near equal to that of the fields we treated of in the foregoing article. We knew that the mould is never ſufficiently broken and divided the firſt year that a field is laid out in beds. Beſides, almoſt all laſt year, the earth was too moiſt to be cultivated properly. The wet mould could not be divided into ſmall particles, nor could it be plowed ſo frequently as to admit of ſowing it ſo early as it ſhould have been.

But every year will not be ſo unkindly to this huſbandry; and when there are alternate changes, ſuch as we have had this year, of wet and fair weather, which will afford time for the different plowings, we may, with ſome certainty, promiſe ourſelves a more abundant crop; ſince, as we have ſeen, it depends chiefly on the good or bad ſtate of the earth.

The whole management of theſe fields having been nearly the ſame with that of the ſecond experiment, it would be needleſs to give a particular detail of it in our account of the other experiments.

EXPERIMENT, No. IV.

THIS field is a very ſtrong good ſoil. In the old huſbandry, it required great ſtrength to plow it, and it was neceſſary to catch the ſeaſons when they were neither too wet nor too dry. It contains 16487 ſquare toiſes. I laid near one half of it out in beds, which, with the alleys, were each about ſix feet wide. Part of theſe beds were ſown the thirtieth of Auguſt. Conſtant rains prevented the reſt from being ſown till the twenty-ſixth of September. An hundred and eighty one pounds of wheat were employed in ſowing the whole. What was firſt ſowed, came up well, and the plants were very ſtrong before winter: but in one place, almoſt all of them were deſtroyed by inſects. I ſowed this ſpot a ſecond time. The freſh ſeed was ſcarce able to riſe before winter, and yielded much leſs than the beds which had not met with the like accident. The wheat of the beds which were ſown the twenty-ſixth of September, was a long time before it ſprung up, owing to the dryneſs of the earth, which continued almoſt the whole month of October. The froſt in November ſtopt the farther progreſs of the plants. Their produce was much ſhort of what was ſowed firſt; which ſhews plainly how eſſentially neceſſary it is to ſow early.

This wheat muſt of courſe grow very unequally. Some beds were extremely beautiful, others middling, and the reſt very poor: yet, throughout the whole, the ears were very large, and well filled with grain; and the crop would ſtill have been a good one, had it not ſuffered by the hail on the third of June, and the other accidents mentioned in the ſecond experiment.

The wheat, being perfectly ripe, was reaped the 13th and 17th of July. It was threſhed two months after, and the whole produce of this half of the field was 3370 pounds of very fine and perfectly clean large-grain'd wheat, which yielded a great deal of flour.

The other half of this field was ſowed in equally diſtant rows with the drill-plough, by which means a great deal was ſaved in the ſeed; for only 479 pounds of wheat were employed to ſow this ground, which, in the common way, would have required about 2016 pounds.

It was ſowed the 23d, 24th, 26th, 27th, and 29th of Auguſt. We could work only a few hours a day on account of the frequent ſhowers of rain.

This wheat roſe very well, and grew very ſtrong before winter, and of a deep green colour, which it retained till it began to ripen. The number of ſtalks increaſed in the ſpring. They grew very long, and bore large ears. In ſhort, they promiſed a fine harveſt. But the hail of the 3d of June ſoon changed the face of the field. It cut off a great number of the ears, broke down many ſtalks, and damaged all thoſe ears whoſe ſtalks were ſtrong enough to remain upright. This misfortune was common to all my wheat.

This wheat, being ripe, was reaped the 9th, 10th, and 11th of July, in very hot, dry weather. It was threſhed a month after harveſt, and yielded 5386 pounds of excellent grain.

Here is an experiment made upon a large extent of ground, cultivated two different ways, and divided into two almoſt equal portions, both of which ſuffered the ſame accidents as equally as could be, according to the beſt of my judgment. This experiment offers us a very intereſting inſtruction.

The deſign of our experiments is, to know which of the different methods of huſbandry is moſt uſeful; which will beſt promote the public welfare, be moſt beneficial to the owners of lands, and bid faireſt to ſecure their productions.

Let us now compare the produce of each half of this field. It will convince us of a truth of great conſequence to be known, *viz.* that land will produce much more corn when cultivated in beds according to the new huſbandry, than when it is only ſowed in equally diſtant rows with the drill-plough; though this laſt method is indiſputably better than the old huſbandry.

We have ſeen that the part of this field, which was ſowed in equally diſtant rows with the drill-plough, produced 5386 pounds of wheat. If it is continued to be cultivated in the ſame manner, it will be in fallow in 1754, and yield no produce: and thus it will bring a crop only every other year.

The other part of this field, which we formed into beds, produced 3370 pounds of wheat, and is already ſown again for a crop to be reaped in 1754. Suppoſing this crop to be only equal to that of 1753, the produce of the two years will be 6740 pounds of wheat. Hence it is evident, that, in two years, the produce of the beds will be 1354 pounds greater than that of the rows. This difference is very conſiderable: and if we would ſee it in a yet ſtronger light, let us extend the ſame calculation to a longer time; for example, to ten years, during which the part ſowed in rows will yield only five crops, which at 5586 pounds a crop, will amount in all to 26930 lb.

The part ſowed in beds will yield ten crops, which at 3370 pounds a crop, make	33700 lb.
The difference in favour of the beds will therefore be in ten years	6770 lb.

We here ſuppoſe the ſeaſons to be, in every reſpect, like the year 1753. But as our obſervations have conſtantly ſhewn that the crops are always greater after the firſt year, which is likewiſe juſtified by the firſt, ſecond, and third experiments, we may even now venture to pronounce, that the part of our field, which is ſowed in beds, in order to be reaped in the year 1754, and which now makes a promiſing appearance, will yield double the quantity it did in 1753. The profit will therefore be much more conſiderable than we have made it in the above calculation.

EXPERIMENT, No. V.

THIS field is of a very ſtiff ſoil. It contains 6112 ſquare toiſes, and lies ſloping towards the Weſt. The beds were well formed, but

but the earth could not be sufficiently broken, nor could it be sown early enough, on account of the frequent rains. It was sowed the 8th and 25th of September, with 139 pounds of wheat. The corn came up well, and made a fine appearance before winter. It throve well during the spring, and when ripe, I cut it down, *viz.* on the 14th and 28th of July, and the crop yielded 2205 pounds of very fine wheat.

EXPERIMENT, No. VI.

THIS field was reaped in 1752, and immediately formed into beds, with a design to sow it that same year. I could not expect that land in so bad tilth could produce much. All I aimed at in what was then done, was to form it into beds a year the sooner. It contained 1928 toises, and was sowed with 45 pounds of wheat, which yielded 724 pounds.

EXPERIMENT, No. VII.

MY desire to practise the new husbandry upon all my lands, as soon as possible, made me plow another field, which had likewise been reaped in 1752. I could however lay only a part of it out in beds: the rest was sowed in equally distant rows with the drill-plough. This field could have but one plowing: nor could that be completed, tho' several ploughs were employed, till the 15th, 17th, and 18th of November. The earth was so moist, that it divided only into large clods. However, I sowed it soon after plowing, not expecting a great crop*. The extent of this field is about 8213 toises. It was sowed with 412 pounds of wheat, of which only a small part rose before winter. The number of plants increased greatly in the spring: they could not branch so much as those of the foregoing experiments, and the grain beginning to look a little shrivelled, I cut it down the 21st, 23d, and 24th of July. Though this wheat had suffered the same accidents as the other, yet it yielded 2646 pounds†.

ARTICLE III.

Experiments made on lands laid out in beds, and of which the first crop was reaped in 1753. Reflections on these experiments.

IN our journal of 1752, we mentioned a person's having sowed at least twenty three arpents in beds. Though these experiments did

* If, says Mr. Duhamel, Mr. De Chateau-vieux had continued to plow his lands in order to sow them with spring wheat, he would have begun the new husbandry with a crop almost as good as that of winter wheat.

† We see, from this experiment, that a diminution of tillage greatly lessens the crop.

not

not anſwer well, we have thought proper to mention them, in order to ſhew the cauſes to which their want of ſucceſs ought to be imputed. They will ſerve to inſtruct us in ſome practices which are more neceſſary than might otherwiſe be imagined, and fix our attention to circumſtances which ought not to be neglected by any one who deſires to make the moſt of his ground.

EXPERIMENT, No. VIII.

THESE twenty-three arpents were laid out in beds about ſix feet wide. The ſoil is ſtrong, and apt to grow very hard. Three rows were ſown in each bed.

Only 460 pounds of wheat were uſed to ſow this field, which yielded but 3150 pounds of very clean grain.

This is a very ſmall crop. Let us ſee what it was owing to.

1. This land was very badly plowed: it could only be divided into great clods, incapable of ſupplying the wants of the plants, and of letting them imbibe the nouriſhment neceſſary for their growth. That the bad ſtate of the land was the chief cauſe of the ſmuttineſs of this crop, appears from this; that the mould in ſome ſmall parts of the ſame field being better divided, the wheat, in thoſe places, was finer, branched tolerably well, and produced a greater number of flouriſhing plants.

2. This field was ſowed too late, *viz.* not till the laſt week in November. Only part of the ſeeds ſprung up before winter. Theſe plants not riſing in a good ſeaſon, could not make the progreſs that might otherwiſe have been expected.

3. Too little ſeed was ſowed. It was the more neceſſary to ſow a larger quantity, as in lands badly prepared, numbers of grains cannot ſhoot at all, and many of thoſe that do ſhoot, are ſo buried under the great clods, that they are not able to riſe. This field was therefore not ſufficiently ſtocked with plants.

Laſtly, the hail we mentioned before, greatly diminiſhed the crop*; which, independent of that accident, would not have been plentiful.

The owner of this field, after remarking the bad conſequences we have been ſpeaking of, ariſing from the defect of culture, has endeavoured to remedy them, by giving, after harveſt, ſeveral plowings, which have broken and divided the earth more thoroughly, and prepared the beds for being ſowed in good time: the quantity of ſeed has

* It is thought to have deſtroyed above half of it.

likewiſe

likewiſe been increaſed; the plants have had time to get ſtrength before winter, and their preſent ſtate promiſes that the next crop will be better. Far from being diſcouraged by the bad ſucceſs of a firſt trial, the perſon we are ſpeaking of, convinced of the excellence of the new huſbandry, is but the more reſolved to purſue it. He juſtly aſcribes the ſcantineſs of this crop not to any defect in the principles of the new huſbandry, but ſolely to its having been badly executed the firſt year. He ſoon perceived that theſe faults might eaſily be remedied, the ſecond year; and therefore has not only continued to cultivate and ſow the ſame field, but has likewiſe ſowed at leaſt twenty arpents more made into beds, which have been much better plowed than thoſe of laſt year: every circumſtance of the new culture has been duly attended to, and the corn, even now, promiſes a more plentiful return.

EXPERIMENT, No. IX.

SMALL experiments have led me on to much greater. As thoſe ſmall ones are neceſſary at firſt, not only to create a confidence in the new huſbandry, but likewiſe to accuſtom people to the practices which it requires, I ſhall relate one of this kind, made by a perſon who has adopted the new huſbandry from principle, and who is every way qualified to inſtruct us, and to execute well what he has once conceived to be right.

A piece of ground, 45 toiſes long, and four toiſes three feet wide, was made into ſix beds, to be ſowed with only two rows. This ſpot could not be prepared till the firſt week in September, nor ſowed till the 24th of October. The earth was very dry, and the wheat roſe unequally, and made little progreſs before winter. By a negligence in the firſt hoeing, almoſt entire rows of the plants were torn up. In proportion to what was reaped, this little ſpot yielded 180 pounds of very fine wheat.

A meaſure of oats which was ſowed in beds in a proper ſeaſon, yielded an hundred and twelve meaſures.

Encouraged by this ſucceſs, the ſame perſon intends to practiſe the new huſbandry in a larger way. He has already formed about eight arpents into beds, which are now ſown: and he will continue in 1755, and the following years, to lay out ten arpents a year in beds, till he has diſpoſed all his lands in that manner.

Another thing intended by this experiment, was, to know whether two rows would not produce a larger crop, in proportion, than three.

The

The ſucceſs of this promiſes very fair; but it will be right to continue trying it, and likewiſe to ſee what multiplying the rows will do. We ſhall ſpeak of this hereafter, in order to determine, by real products, what number of rows will beſt ſuit this huſbandry.

ARTICLE IV.

Experiments made on fields ſowed in equally diſtant rows with the drill-plough, by ſeveral lovers of agriculture.

EXPERIMENT, No. X.

THIS, and the following experiment, were made by the ſame perſon who made the ſeventh, mentioned in our journal of 1752, the reſult of which encouraged him to proceed to large ones, and to prove the advantages of this huſbandry, by new examples. To be the more exact in theſe experiments, he reſolved to try the old and the new huſbandry in the ſame field.

For this purpoſe he choſe a field, the ſoil of which is reckoned equally good in every part. The whole extent is 6727 toiſes and 18 feet. Of this, 3502 toiſes 18 feet were deſtined to be ſown in the old way, and 3225 toiſes to be ſown in equally diſtant rows with the drill-plough. The whole field was equally plowed and dunged, and ſowed the ſame day, *viz.* the 19th of September, with the ſame wheat. In ſhort, there was no other difference than in the quantity of ſeed, and the manner of ſowing it.

The part of this field which was ſowed in the old way took up 698 pounds 10 ounces of wheat, which produced 2979 pounds of very fine grain. This is about four and a quarter for one.

The other part of the field was ſowed with the drill-plough, with 243 pounds, which yielded 3187 pounds two ounces of very fine large grain'd wheat. The proportion here is as thirteen to one.

We find in favour of the drill-plough; firſt, that though the ſurface of this ground was 277 toiſes 18 feet leſs than that of the other, yet it produced 208 pounds two ounces of wheat, more than the other: and ſecondly, that, deducting the ſeed of each crop, this neat produce is ſtill more conſiderable, as appears by the following account.

Produce of the part ſowed in the common way . .	2969 lb.
To be deducted for the ſeed	698 lb.
Remains . .	2271 lb.

	lb.	oz.
Produce of the part ſowed with the drill-plough	3187	2
To be deducted for the ſeed . . .	243	
Remains . . .	2944	2

Which is 663 pounds two ounces more than the produce of the old huſbandry.

All the field was ſomewhat damaged by the hail of the 3d of June, which leſſened both the crops a little.

EXPERIMENT, No. XI.

ANOTHER field, the ſoil of which is better than that of the former, having been well plowed, was ſowed in equally diſtant rows, with the drill-plough, the tenth of October. It contains 2172 toiſes and 16 feet, was not dunged, and was ſowed with 121 pounds eight ounces of wheat, which yielded 2979 pounds of very fine clean corn; which is 24 for 1.

This return is very conſiderable, and greatly ſurpaſſes that of the foregoing experiment. It ſhould be remembered, that the ſurface of this field is leſs. 'Tis true it received no damage from the hail.

EXPERIMENT, No. XII.

WE mentioned in the journal of 1752, a perſon's having ſown about 125 arpents in equally diſtant rows, with the drill-plough; and we obſerved, that a great part of the ground could not be well plowed, and that the whole of it could not be ſowed till November and December. Theſe two circumſtances gave no room to hope for much ſucceſs. About 40 arpents, which were the laſt ſowed, were dunged: but theſe yielded the leaſt crop of any.

This great extent of ground was ſowed with 9932 pounds of wheat. To have ſown it all in the common way, would have required 29524 pounds of wheat. Conſequently here is a ſaving of 19592 pounds of wheat, in the ſeed.

The ſoil of theſe fields being of different qualities, their produce was proportioned thereto, varying from exceeding good to very bad. The 125 arpents yielded in all 86058 pounds of wheat. The crop

crop would have been more confiderable, if about 30 arpents had not been greatly damaged by the hail. The lofs it occafioned, fhews plainly the great probability of having larger returns in other years, when we become more perfect in the practice of the new hufbandry, to the want of which the bad fuccefs of this firft trial has certainly been owing in a great meafure. All the lands of this farm are now fowed again with the drill-plough. They confift of about 160 arpents, and afford a pleafing profpect for the enfuing harveft.

EXPERIMENT. No. XIII.

A Field of three arpents and a half, was fowed in the middle of October with 243 pounds of wheat. It ufed generally to require about 850 pounds. It yielded 2268 pounds. *This*, adds the perfon who has fent me this account, *is as much as I have had from any other field fowed in the old way.*

EXPERIMENT. No. XIV.

THE fame perfon who made the foregoing experiment, fowed another field of about four arpents, of a poorer and colder foil, towards the middle of November, with 333 pounds of wheat. In the old way, it ufed to be fowed with 972 pounds. It yielded 1260 pounds. The corn in this field remained thin. It did not branch fo well as that of the former. The perfon who fends me this account of thefe two experiments, adds: "It muft be obferved, that "the drought, as well of the autumn as of the fpring, was unfavourable, efpecially to the late fown wheat. Thefe experiments "have encouraged me to purchafe a drill-plough, and to fow all my "lands with it in equally diftant rows, according to the new method, this year 1753: only I have obferved to fow earlier, *viz.* "between the middle of Auguft and the middle of September; and "thicker, that is to fay, 45 pounds, on the fame extent of ground "where I fowed but 34 pounds and an half, and 41 pounds and an "half in 1752. My plants, hitherto, make a fine appearance, and "are very thick: their blades are large, and the whole is in great "vigour."

EXPERIMENT. No. XV.

I Have extended my experiments to an eſtate where I have not time to make any long ſtay myſelf, ſo that what is done there is left to the diſcretion of ſervants, whoſe eye, as is well known, is not like that of their maſter.

The lands of this place are very poor: they produce little corn, but very good. In 1752, they were very badly plowed, and this plowing was ſpoilt by the rains, juſt as the ground was going to be ſowed. I ordered the whole to be ſowed with the drill-plough, except an arpent and an half, which was ſowed in the old way. Some few fields were a little better plowed than the reſt. Theſe produced pretty good wheat. The others were very poor. However, I have reaſon to be pleaſed with my having ſowed in this manner. I judge of it by the produce of the arpent and half, which was ſowed in the common way, and which yielded me no more than exactly the quantity of the ſeed beſtowed upon it.

The true cauſe of this was the bad condition of the lands. They are in much better tilth this year. All of them have been ſown with the drill-plough, in a favourable ſeaſon, and my ſervants aſſure me that the corn riſes finely.

ARTICLE V.

Account of the crops produced during ſixteen ſucceſſive years, by fields cultivated and ſowed in the common way, and of which part was conſtantly dunged; compared with a crop of the ſame fields cultivated without dung, according to the new huſbandry, even ſuppoſing them not to yield more than they did in 1753, which was their firſt crop, and which was greatly diminiſhed by the unforeſeen and extraordinary accidents already mentioned.

THE reſult of our experiments would be of little uſe, if it extended no farther than our own private inſtruction. To render it of more general ſervice, we ſhall here give a compariſon of the produce of lands cultivated according to the old huſbandry, and according to the new, that every one may judge which of the two will anſwer beſt.

This parallel will ſhew how much the new huſbandry is ſuperior, in in point of advantage, to the old. We are to ſuppoſe all the circumſtances of the ſeaſons to be like thoſe of the years of which we have compared the products. But as the expence of culture is an object well worth conſidering, and as that expence may not be equal in both ways, I beg leave to lay down here as a fact, " That the " charge of the new culture is leſs than that of the old." I have tried it, and find it ſo; as I ſhall, hereafter, prove beyond diſpute.

By the old culture, in the eſtate I now cultivate in the new way, I ſhould have had but two fields ſowed in 1752, to be reaped in 1753; *viz.* that of the experiment No. IV. and that of the experiment No. V. Theſe two fields contain together 22599 toiſes. I have calculated the produce of theſe two fields during 16 years, *viz.* from 1730, to 1745 incluſively. They have yielded eight crops in this time, the total produce of which has been 146863 pounds of wheat: deducting from which 42130 pounds for the ſeed ſowed in the eight years, the neat produce will be reduced to 104733 pounds.*

It is proper to obſerve, that this wheat was meaſured every year in the barn, as ſoon as it was threſhed, and before it was ſifted: an operation which always occaſions a conſiderable diminution, tho' we make no allowance for it here.

Let us now ſee what crops the preceding experiments give us room reaſonably to expect from the ſame two fields in ſixteen ſucceſſive years of the new huſbandry; to judge only by that of this firſt year 1753, unfavourable as it is.

The field, No. IV, was ſowed, half in beds, and half in equally diſtant rows. I am obliged to ſuppoſe it to have been ſowed entirely in beds; for it cannot be doubted but that the part which was ſowed in rows, would have produced as much as the other: conſequently the whole crop of the two halves, at 3370 pounds each, would have been 6740 pounds.

As the ſame fields yield a crop every year, in the new huſbandry, we ſhall have ſixteen crops inſtead of eight: ſo that multiplying the firſt year's crop, 6740 pounds, by ſixteen, the total produce will be 107840 pounds: to which muſt be added that of the experiment No. V, which was 2205 pounds; which being alſo multiplied by ſixteen,

* The fields which were ſowed alternately during the eight other years, though their extent was ſomewhat larger, yielded ſtill leſs grain. Their whole produce was but 114331 pounds.

ſixteen, will produce a farther quantity of 35280 pounds for the ſixteen crops. This, added to the amount of the experiment No. IV, will make in all 143120 pounds of wheat for the ſixteen years.

If we afterwards deduct from this, the quantity of ſeed uſed in theſe two fields during the ſixteen years, which amounts to 8016 pounds, the neat produce will be	135104 lb.
In the old way, the ſame fields would produce, in ſixteen years, only	104733 lb.
The difference, in favour of the new culture, is therefore	30371 lb.

Beſides the advantage of reaping a much greater quantity of corn, there are others which highly merit our attention. This corn is not mixed with any ſeeds of weeds, and its quality is greatly improved by the abundance of nouriſhment which the plants are ſupplied with by the frequent ſtirrings of the earth in this huſbandry, more than in the old.

But how fine a proſpect does the propoſition which we advanced before, afford us yet beyond all this! *viz.* "That the crops of the "ſecond and following years, would be ſtill more plentiful than "the firſt." What ſome might then think only an object of hope and ſpeculation, is already realized, and proved by experiments. All this deſerves the moſt ſerious attention. The new huſbandry will certainly, in time, acquire a ſuperiority over the old, greater than we can now imagine.

ARTICLE VI.

Proofs that the beſt field in the country, tho' the greateſt part of it was dunged, yielded leſs wheat than thoſe of the experiments No. II. *and* XI, *in which no dung was uſed.*

THE proofs of the advantages of the new huſbandry, cannot be multiplied too much; and all thoſe which are the reſult of experience, deſerve to be communicated to the public.

The field we are going to ſpeak of, is generally, and juſtly, reckoned

reckoned the beſt in the country. Its ſoil is excellent, very deep, and extremely fertile. This field is dunged very often, Its nearneſs to the farm-yards renders the carriage of manure extremely eaſy, and is the cauſe of its getting perhaps more of it than may be neceſſary. Its ſituation too is excellent, riſing on all ſides above the neighbouring grounds, and the high-ways which ſurround it; by which means it is leſs expoſed to be hurt by wet, the water finding an eaſy drain from off it.

The extent of this field is 6087 toiſes. It was ſowed in 1752, for the harveſt of 1753, and the greateſt part of it was well dunged.

It is not the cuſtom of the country I am ſpeaking of, to deſcribe the extent of a field by the number of arpents it contains, but by the number of meaſures of wheat with which it is ſowed. Eight meaſures uſed generally to be employed to ſow this: but the quantity of ſeed was leſſened this laſt time, and only ſeven meaſures were ſown. We have hitherto ſuppoſed the ſurface of this field to be equal to that of the other fields of the ſame country, in which eight meaſures of ſeed are ſowed.

But as I was deſirous to be more preciſely exact, in order to form the compariſon I purpoſed making, I had recourſe to the geometrical plans of the lands, and found the contents of this field to be, as I ſaid before, 6087 toiſes: now, the cuſtom of this village is always to ſow at leaſt eleven meaſures in a ſpace like this. One field, among others, very near to this, and which is but 24 toiſes and 32 feet larger, has always been ſowed with twelve meaſures.

A new cauſe of the fruitfulneſs of this field, unknown before my obſervations, is, that the farmer wiſely took care to ſow it with a leſs quantity of ſeed. The plants throve better, when the land was not over-ſtocked with them. This field will therefore help to prove the truth of one of the firſt principles of the new huſbandry, *viz. That the quantity of ſeed generally uſed, ought to be diminiſhed:* a propoſition which deſerves our entire confidence, becauſe the ſeed here has, time out of mind, been reduced to eight meaſures, and they have been ſufficient to produce very plentiful crops. The farther reduction made in 1752, to ſeven meaſures, muſt alſo be approved of, ſince the crop it yielded was very fine.

Theſe preliminary obſervations ſeemed neceſſary, before we proceeded in our detail. This field was ſowed with about 150 pounds of wheat. It was finer during the whole ſummer, than any wheat in the common way. It was reaped at a proper time, and yielded about 6646 pounds; from which muſt be deducted, firſt, the 850 pounds of ſeed, and ſecondly, the value of the dung, which is equal at leaſt to 1260 pounds of wheat; together 2110 pounds; which, deducted from 6646 pounds, the total produce, leaves for the neat produce 4536 pounds.

The crop of 1753 was diminiſhed by the hail of the third of June. The value of this loſs is not known: but we may fairly compare it with the experiment, No. 2. which likewiſe ſuffered by the ſame hail. We confeſs that this compariſon is not abſolutely exact, with reſpect to this accident: but it muſt alſo be granted that this circumſtance cannot occaſion any very great error. We muſt likewiſe premiſe, that we ſhall not reckon the produce of a ſmall ſpot which is pretty commonly ſowed in March in the year of fallow, becauſe it hardly equals the expence of dung and plowing.

The neat produce of the experiment No. 11, on a field ſowed in equally diſtant rows, was 2857 pounds 8 ounces. But the extent of that field being but 2172 toiſes, we muſt calculate what the crop would have been in proportion, if that extent had been 6087 toiſes, ſuppoſing it of the ſame quality. We ſhall find that the field on which our experiment was made, would have produced neat 8006 pounds of wheat: deducting from which, 4536 pounds, for the neat produce of the field cultivated in the old way, the difference in favour of the new culture, without dung, will be 3470 pounds of wheat.

We have ſeen by the experiment No. 2, that this field laid out in beds, and having borne its ſecond crop, yielded neat 1540 pounds of wheat. Its extent is but 1650 toiſes; ſo that we are to ſee what crop it would have yielded if its extent had been 6087 toiſes, ſuppoſing the quality of the ſoil to be the ſame. The rule of three ſhews us again, that its neat produce would have been 5681 pounds of wheat, which we are to double for the amount of the next year's crop; every year yielding a crop in the new huſbandry: whereas the field it is compared with, would lie fallow this year. Thus two years will yield 11362 pounds of wheat; from which deducting 4536 pounds for the neat produce of the ſame field cultivated in the old way during the ſame ſpace of time, the difference will be 6826 pounds of wheat, in favour of the new huſbandry.

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ARTICLE VII.

Reflections and obſervations on the practice of the new huſbandry.

THE chief object of our reflections laſt year was, the effect which plowing and culture has upon plants. They ſeem to us to be confirmed by the following obſervations.

1. The productions were greateſt in thoſe places where the earth had been moſt looſened and brought to the fineſt tilth.

2. We have ſeen plainly that in order to improve our tillage, it is neceſſary to make the great furrow in the middle of the alleys very deep, becauſe that furrow being afterwards filled up, and a new bed made over it, there is a greater depth of light well looſened mould immediately under the roots of the plants.

3. We can affirm, that we have this year, without much trouble, plowed our beds from fifteen to eighteen inches deep, which is very conſiderable: but we muſt not flatter ourſelves, that this depth can always be attained the firſt year: it is by continuing this ſame culture that we ſhall inſenſibly reach it.

4. To have great ſucceſs, requires proper care and judgment in performing every part of the new huſbandry. The culture which is well executed, will be of very great uſe; but that, on the contrary, which is badly done, will be of no ſervice to the plants, and may even prove very detrimental to the next year's crop.

5. To perform this culture with advantage, it is therefore neceſſary to obſerve this important maxim of tillage, ſo little attended to by many farmers, *never to ſet the plough to work, when the earth is too moiſt.* I have adhered to it ſtrictly, and have never ſuffered my lands to be touched till they were dry. We have tilled when the weather has been very dry and very hot, and then it was that our culture had the beſt effect: the ſtiffeſt lands having been broken by the preceding plowings, was provided with the moiſture neceſſary for plants, from its ſurface to the bottom of the furrows; and the plants were ſenſibly benefited by all our frequent ſtirrings.

6. I was ſo ſtruck with it, that I marked ſeveral ſtalks, to ſee how much they grew each day. From the time that the ears began to appear, till they had done bloſſoming, I found that they grew an inch in four and twenty hours. The hotteſt days were thoſe in which the ſtalks grew moſt; whilſt all vegetation ſeemed almoſt ſuſpended in the wheat in the common way.

7. This obſervation led me to another. I was greatly ſurpriſed one day to find my ſtalks juſt as I had left them the day before. The next day, and the day after, I found them ſtill the ſame: in ſhort, they grew no longer from that time.

So ſudden a change raiſed my curioſity greatly, and I reſolved to find out the cauſe of it. The time when they ceaſed to grow, was immediately after they had done bloſſoming. I judged that from that time all the ſap was conveyed to the ear to form the grains of the wheat, and that the reſt of the plant had only what was neceſſary to prevent its drying too ſoon. This diſpenſation of the nutritive juices ſeemed to me very remarkable: all their forces ſeem then to unite, to form, fill, and ripen the grain, which is the moſt uſeful part. I was afterwards confirmed in this, by obſerving that it was from that very time that the ſtalks and blades began inſenſibly to loſe their deep green colour, and that this green grew lighter and lighter every day: a ſure ſign of a diminution of ſap in thoſe parts.

8. It is likewiſe of very great importance to know which is the moſt proper time for ſowing lands: for the growth of plants depends greatly on this circumſtance. Late ſowings have not anſwered: but the early ones have produced plants, whoſe vigour has enabled them the better to reſiſt the winter's cold, and to branch out the more abundantly. By attending to this circumſtance, the farmer will enjoy the deſirable advantage of having his corn ripen early, and of its being leſs expoſed to the dangers of the ſummer ſeaſon; for we have ſeen that the wheat which was ſowed firſt in the new method, ripened thoroughly as ſoon as that which was ſowed in the old way. It is proper to know this, in order to be ſenſible of the neceſſity of beginning to plow early, that the ſeed may be ſowed in due time.

9. I muſt beg leave to make a few reflections again this year on the quantity of ſeed moſt proper to be ſown. It is of the utmoſt importance to know how to proportion the quantity of the ſeed to the ſtrength and richneſs of the ſoil, ſo that each may have its due proportion. The experiments already made, help to direct us; but I think others ſtill neceſſary before we can truſt abſolutely to our knowledge in this point.

At preſent, I ſhall only adviſe ſowing the ſame quantity of ſeed that I did in 1752. I fancy that proportion will not differ greatly from what a longer practice will ſhew to be the beſt. However, the ſame quantity of ſeed will not do for every ſoil. It muſt be varied with judgment, and regulated according to the circumſtances of

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the ſeaſon, and the better or worſe condition of the ground. I think too, that in the firſt, and even the ſecond year of the trials which may be made, it will be proper to ſow a little thicker than I did in 1752. The farmer will eaſily perceive, that when his lands are well looſened and brought to a good tilth, they will require leſs ſeed: but till then, he will do well not to be over-ſparing of it.

10. We cannot yet determine ſo exactly as we could wiſh, what breadth the beds, including the alleys, ſhould be of, to make the ground produce the greateſt quantity of corn; nor whether it would be beſt to ſow more or leſs than three rows. We confeſs that we ſhould be glad to ſee a longer ſeries of accurate experiments, and to have a greater knowledge of this matter, before we pretend to fix it. Our beds have always been about ſix feet wide.

Mr. Duhamel, who firſt introduced this new huſbandry in France, intends to make experiments by ſowing only two rows. If they ſhould yield more grain, the width of the beds may certainly be diminiſhed: and as it is of conſequence to multiply and vary experiments, in order to determine this point, we now have ſeveral beds ſowed, ſome in two, and ſome in three rows. I have likewiſe tried what multiplying the number of rows in ſome fields would do; and the reſult of this experiment promiſes an advantage in that way of ſowing. The ſucceſs of this firſt trial was as follows.

When the field of the experiment No. 2, was ſowed, I obſerved among the reſt ten beds which the plowman had made wider than the others. I was ſorry at firſt, that any part of the ground ſhould be loſt: but on thinking farther of it, I determined to ſow thoſe beds with two turns of the drill-plough, and conſequently to plant them with ſix rows of wheat. I did ſo: and when the firſt plowing after winter was given, little regard was paid to the two outſide rows, which were torn up by the plough in ſeveral parts, ſo that there remained but four or five rows in thoſe places.

The wheat of theſe beds grew as high and branched as much as that of the others, in which there were but three rows, not excepting even the middle row. I examined them frequently, with great care, and was aſſiſted therein by ſeveral perſons very capable of judging and making good obſervations. The only difference we could diſtinguiſh, *and that was ſcarcely perceptible*, was in the ears, which we thought rather the ſhorteſt in the middle rows: but as there was a greater quantity of them, we judged that theſe beds would yield moſt grain.

We were not miſtaken; for their produce was as follows. The ten beds which had been ſowed with ſix rows each, yielded 91 pounds of wheat more than ten beds which were ſowed with three rows each. But, as this reſult does not ſet the matter in a ſufficiently clear light, we muſt have recourſe to the following calculation. The ſix row'd beds took up more ground than thoſe which had but three rows: two beds more might have been made out of the ſurplus of their breadth: ſo that there would in that caſe have been 12 beds inſtead of 10. The queſtion therefore is, whether this ground, made into 10 beds, produced more than it would have done if it had been made into 12 beds of three rows each. To which I anſwer, that it did produce 38 pounds more: and that there was likewiſe a ſeventh part more ſtraw.

As this experiment deſerved to be repeated, I have tried it in a larger way. I have laid ſeveral arpents out in beds of about ſeven feet wide: they are ſowed with ſix rows: the plants are very fine, and I impatiently wait the event.

Though I have continued not to dung my fields, the plants ſtill grow very tall, and produce fine long ears, well filled with plump grain.

I am indebted to the new huſbandry for the recovery and improvement of worn-out meadows. They have already yielded me plenty of fodder. The value of this ſhould be added to the produce of the fields; becauſe the new huſbandry is the immediate cauſe that manure can be ſpared to enrich thoſe meadows.

ARTICLE VIII.

General diſpoſition of the lands for the crop of 1754.

THE more I have ſtudied the principles of the new huſbandry, the more I have been convinced of the advantages attending it. My experiments have not only confirmed me in this opinion; but they have likewiſe ſhewed me that my practice has been conſiſtent with thoſe principles. This made me determine to lay the whole of one of my farms out in the new way, as ſoon as poſſibly I could; its extent being no more than I can direct almoſt all the whole culture of myſelf.

I have completed it this year. All the fields, of which only half uſed to be ſowed every year in our old way, are now laid out in beds. I have ſowed them all, with a deſign to continue doing ſo

for

for the future every year. They look exceeding well hitherto: the plants are extremely fine, and promife a greater crop next year, than that of the experiments of the foregoing years.

Thefe experiments have likewife made a ftrong impreffion on feveral perfons in this country, each of whom judged of the new hufbandry, as his inclination, or profpect of advantage, directed. 'Tis true our farmers are more generally inclined to fow their lands in equally diftant rows, with the drill-plough, than to lay them out in beds, the proper management of which, fay they, is attended with much more care and trouble. My drill-plough is preferred on account of its fimplicity. It began to be ufed laft year, and numbers of fields near this city (Geneva) have been fowed with it this year.

Several of our peafants have likewife tried the drill-plough, and their example will be of confequence hereafter. Their unwillingnefs to come into any new practice, is well known: but this feems to get the better of their prejudices; and the profpect they now have of greater crops than ufual, makes them regret their not having fowed a greater extent of ground this way.

We have about an hundred and twenty arpents fowed in beds, and upwards of eight hundred and fifty fowed in equally diftant rows. Such large experiments, and made on different foils, cannot but afford new inftruction: the facts will be better afcertained, and people will be more thoroughly convinced that the greater produce of the crops is owing to the new hufbandry, and not to favourable circumftances, to which they are too apt to impute it. Thefe experiments, fay they, have been made on the very beft foils; it is much eafier to prepare 100 or 200 toifes of ground, then an extent of feveral arpents; thefe little fpots have been cultivated with vaft care; it is almoft impoffible to beftow the fame attention on large tracts of land.——Luckily, feveral lovers of agriculture are making large experiments, which already prove that the new hufbandry may eafily be practifed in any extent of ground whatever.

CONCLUSION.

ANY one may now judge, by the experiments which have been made thefe laft four years, and by the fuccefs which has attended them, how far the principles of the new hufbandry are juftly founded, and how far we are in the right road to give ftill farther demonftrations of the excellence of them.

The lands on which it has already been practiſed, leave no room to doubt that all its operations may be performed with eaſe: and at the ſame time they prove to every one who ſhall be inclined to cultivate any part of their farms in the ſame way, that they may do it with equal advantage.

Convenient inſtruments for executing this culture are already invented and made. The uſe that has been, and ſtill is made of them, ought to increaſe our confidence in them. It is by their means that the two moſt eſſential articles towards ſecuring ſucceſs, are obtained: the firſt is, the means of forming, plowing, and cultivating the beds, with great eaſe and little expence: the ſecond, that of ſowing land more regularly, and of giving it the exact quantity of ſeed that may be thought moſt proper, by means of the drill-plough, which buries the ſeed at its proper depth in the furrows, covers it over, and, in ſhort, does the whole buſineſs of ſowing with great diſpatch, and a conſiderable ſaving of ſeed.

The chief obſtacles being now removed, we may reaſonably hope that the new huſbandry will gain ground every year. Numbers of intelligent perſons, truly zealous for the public good, have ſeen how my lands were cultivated, and have been curious enough to be preſent at all the operations of this culture. They have frequently told me, that the public have not a right notion either of the new huſbandry in general, or of the eaſe with which it is performed. They themſelves have wondered at it, and preſſed me to publiſh a circumſtantial account of the manner in which I have introduced this new method in our country, that they too might inſtruct their countrymen therein. I have yielded to their ſollicitations; and ſhall continue to communicate my farther obſervations in this fourth year of my practice of the new huſbandry.

SECTION IV.

Experiments made by M. Lullin de Chateau-vieux, *in the year* 1754.

MY experiments in the year 1754, will afford a freſh proof of what I ſaid in my accounts of thoſe of the preceding years, *viz.* that land, by continuing to be cultivated in the new way, will become more fertile, and produce greater crops even the ſecond or third year; becauſe the earth will then be in a looſer ſtate, which is highly neceſſary to procure plentiful productions.

This proof ought to be received with ſo much the more confidence, as as the ſeaſons of the year 1754 were not favourable to the production of corn. It was an extremely dry year; the earth had not the degree of moiſture which is neceſſary to promote the growth of plants; the wheat was in general very thin and low, and numbers of farmers did not reap above half the crop the ſame lands had yielded them in 1752.

The wheat ſuffered great accidents early; for it was *ruſted* in October and November. Till then, it was very ſtrong, and promiſed well; but afterwards, it turned yellow on a ſudden. The *ruſt* made a great progreſs. I met with places where the ground was entirely covered with the powder of this diſtemper. The vegetation of the plants before winter, was from that time nearly at a ſtand.

They were likewiſe hurt, and perhaps ſtill more, by the froſts which began again in March, and laſted till the 20th of that month. Theſe froſts rooted up prodigious numbers of plants of the wheat ſowed in the common way, which withered in a few days. Some fields ſuffered ſo much by this accident, that they were obliged to be plowed anew, and ſowed again with oats or other ſpring corn.

To ſhew the reſult of my experiments the more diſtinctly; I ſhall range them in the following order.

The firſt article will contain an account of three experiments made on lands laid out in beds, and which have born a third and a fourth ſucceſſive crop; to which I ſhall add ſome remarks particularly relating thereto.

In the ſecond article, I ſhall relate four experiments which I made on lands formed into beds, which had born a ſecond crop. Theſe too will be accompanied with ſome reflections.

The third article will give an account of three experiments made on lands formed into beds, which have born a firſt crop; and of the manner in which I tilled them, in order to prepare them for ſowing. This will give riſe to ſeveral remarks.

The fourth article will inform the public of ſome other experiments made on lands laid out in beds, which have yielded a firſt and ſecond crop. This will be followed by ſome intereſting obſervations.

In the fifth article, I ſhall relate ſeveral experiments made by divers lovers of agriculture, on lands ſowed in equally diſtant rows with the drill-plough.

The ſixth article will contain an account of the produce of ſeveral fields ſowed in equally diſtant rows, with the drill-plough.

In the feventh, I fhall make fome general obfervations on the experiments contained in the foregoing articles.

I fhall fpeak in the eighth article, of the experiments I have made on beds fowed with fix rows of wheat; and compare their produce with that of others, fowed with only three rows. The refult of this, will enable us to judge how many rows it may be beft to fow.

In the ninth article, I give a circumftantial detail of an experiment which I made in order to be more fure of *the beft way of fowing the beds*; and to be able to determine more exactly what quantity of feed is moft likely to produce the greateft crop.

Before I enter upon either of thefe fubjects, it will be proper to obferve, that I have ufed no dung, or any fort of manure, for my fields or beds; purpofely to be the more certain of the effects of this new culture, and to fee what land could do by mere dint of ftirring it. My dung has been laid, as ufual, upon my grafs lands, where it continues to be of wonderful advantage.

I fhall ufe the fame weights and meafures as in my former experiments, *viz.* the toife of thirty-fix feet, and the pound of 16 ounces.

ARTICLE I.

Experiments made on lands formed into beds, which have yielded a third and a fourth fucceffive crop: with fome obfervations particularly relating thereto.

EXPERIMENT, No. I.

N B. *This field is marked with the fame number in the journals of* 1751, 1752, *and* 1753; *and in the fame fpot on which I made my firft experiments in* 1751. *This is the fourth fucceffive crop.*

THE fmall fpot of ground on which I made the experiment I am going to fpeak of, being only a fingle bed, 160 feet long and five feet wide, would not deferve to be taken notice of in this account, were it not for a circumftance extremely remarkable, and the more worthy of attention, as the fuccefs it was attended with, affords an unexpected and indifputable proof of the fruitfulnefs which may be expected from lands cultivated in the new way. If farmers will but continue it to the third or fourth year, they will then be fure of having their lands in excellent tilth, well loofened and divided, and its pores properly opened and exceedingly multiplied. That this will

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be the cafe, cannot be doubted. Yet fome may perhaps be weary of cultivating their lands for fo long a time, before they attain that perfection of culture, which we have all along declared to be neceffary, in order to have great fuccefs.

To prevent the difguft which might arife from fo diftant an expectation, and to encourage the lovers of the new hufbandry, I fhall obferve, in the firft place, that there are, in every country, confiderable tracts of good land, which will not require fo long a time to bring them into proper tilth. I am, however, fenfible how ferviceable it would be towards haftening the progrefs of the new culture, in lands of an inferior quality, to be able to find out fome fhorter way of breaking and loofening the earth: and accordingly I have tried whether it cannot be done.

I have fucceeded therein, fully to my fatisfaction, and can now fay with certainty, that lands may be brought to a fufficiently loofe ftate, even the firft year, by plowing them in the manner I fhall explain in the third article, experiments 8, 9, and 10, the crops of which were very good.

The moft certain, and moft inconteftable principle of the new hufbandry, is that *the earth muft be thoroughly loofened by deep and frequent plowings and repeated culture.* In confequence of this, I examined very carefully whether my lands were more loofened and rendered lighter by my manner of performing the operations of the new hufbandry, than they were when cultivated in the common way. All my obfervations convinced me that they were.

The firft glance of the eye fhewed me, that the furface of my lands was fmoother: on founding the plowings, I found them deeper; lefs ftrength was required to plow: two horfes, and fometimes only one, or a fingle ox, did with eafe, what would otherwife have required at leaft double that number of cattle. A manifeft proof that my lands were in excellent tilth.

If, after having thus examined the lands themfelves, I confidered their productions, I had a frefh proof of their being brought to that ftate of pulverifation, in which alone plants can thrive well. My wheat was infinitely ftronger than that in the common way; and, on examining it minutely, I found that each plant had a greater quantity of roots, ftronger, thicker, and much longer, than other wheat, and that the blades were broader and longer, and of a much deeper green. The plants had generally a great number of very thick and long ſtalks, which were crowned with large ears quite full of grain, and much heavier than thoſe of the common wheat.

All theſe obſervations were ſufficient to convince me, that my lands were in the ſtate I wiſhed them to be; that is to ſay, that they were looſened and divided ſo as to be capable of yielding great productions.

It was therefore leſs to ſatisfy myſelf, than to give the public a farther proof of the excellence of the new huſbandry, that I made the experiment I am going to relate. It is an intereſting one in every reſpect; and I make no doubt but that it will induce many others to make the like trial. I can aſſure them that they will find it well worth their while.

The harveſt of 1753 being over, I immediately ſet about plowing my fields, and forming the new beds which were to be ſowed. The year was a very dry one. I uſed frequently to walk, both over the beds that had juſt been reaped, and over the fields cultivated in the common way, where the corn had likewiſe been lately cut down.

The firſt thing that ſtruck me in theſe walks, was, the difference which I found in the ſtubble. That of the fields cultivated in the common way was ſo poor and weak, that it ſcarcely oppoſed the motion of my feet. That of the beds, on the contrary, reſiſted greatly: I often felt it break under my feet, and frequently met with tufts of 20, 30, 40, and ſometimes more ſtalks, which ſtopt me ſhort, like ſo many little buſhes.

I am the more particular in my account of this ſtubble, becauſe it ſhews the great ſtrength of the plants; which they would not have had if the earth had been leſs well prepared. Beſides, this ſtubble has its real uſe, as I ſhall ſhew elſewhere. *It is a much better manure for land than the common ſtubble is.*

This obſervation led me to examine carefully what other differences I could find between the fields cultivated either way. The moſt important is, the ſtate of compreſſion which thoſe in the common way were in after harveſt. They offered nothing pleaſing or ſatisfactory to the eye; the earth was extremely hard, cloſe and compact; and its ſurface almoſt as firm as that of a beaten road.

The fields in the new way, prepared by better plowings made at proper ſeaſons, were, on the contrary, ſtill very light and ſoft in the middle of the beds, in the partitions between the rows of ſtubble. The earth gave way like ſand, when trod upon; and *though it was very dry,* I thruſt a ſtick of green willow eight or ten inches deep into

into it, with great eaſe, though I could not by any means puſh it at all into the land which had been cultivated in the common way. This plainly ſhews the better ſtate of the former.

Laſtly, I compared theſe fields with thoſe that were in fallow, which had been plowed, and were intended to be ſowed in autumn. I found the tops of the late reaped beds, in much better condition than the common fields which were under fallow. This made me immediately conclude, that theſe very beds might be ſowed again with ſucceſs, in the ſame places where the corn grew the year before, *without plowing them.*

I thought, however, that if this experiment did ſucceed, it would be owing in ſome meaſure to the culture of the alleys, and that this would fully prove the uſe which they are of. This was another reaſon for my trying this experiment.

It appears by this, that my chief deſign was to try whether the ſame ground could be ſowed, in the ſame place, two years running, without plowing; and to ſee how ſtrong the plants would, in that caſe, be at harveſt.

I was conſequently to avoid, in ſowing it, every thing that might ſupply the want of plowing, and to ſtir only juſt ſo much earth as was abſolutely neceſſary to bury the ſeed. This conſideration prevented my making uſe of the drill-plough, the ſhare and harrow of which divide and looſen the earth perfectly well, as deep as the ſeed is planted.

All I did to this bed, was, barely to pull up the ſtubble, and afterwards draw a line with a ſtick, as if it had been for ſowing lettice. The ſeed was dropt by hand into three of theſe channels which were afterwards covered over with a rake.

The birds had done great damage to the wheat I ſowed the year before in this ground. To avoid this accident now, I ſowed a kind of corn called *ſpelt*, which is uſed in many places inſtead of wheat. The Germans cultivate it greatly. The ſpelt which I ſowed is of a ſomewhat different kind. The grain of both ſorts is incloſed in double huſks, very thick, and of which the outer one does not open eaſily, ſo that the birds cannot pick out the grains.

I ſowed this bed very thick, concluding that the plants would not branch much. And I ſowed it early, *viz.* the nineteenth of July, becauſe this grain remains a whole year in the ground, from the time of ſowing, till it is ripe. I uſed in all eleven ounces of ſeed, which ſoon ſprung up, and the plants made very ſtrong ſhoots; but I thought them too thick.

As this ground had not been plowed, I thought it was proper to aſſiſt the plants otherwiſe as early as I could. I had them weeded the twenty-ſecond of Auguſt.

Theſe plants grew ſo extremely thick, that their blades covered the ground four feet round, before winter, in ſuch manner that the earth could not even be ſeen through them. The rows were from a foot to a foot and an half high, and the whole had already ſpindled, which made me ſorry I had ſowed ſo early; fearing leſt plants ſo forward before winter, as theſe were, ſhould be killed by the froſt; and, in order to ſecure ſome reſource in caſe that ſhould happen, I ordered part of the bed to be mowed the ſixth of November, but did not touch the reſt. I muſt here obſerve by the way, that *the part which was mowed had feweſt ſtalks at harveſt.* At the ſame time I gave the alleys their firſt plowing before winter. Upon opening a furrow near the rows, I ſaw ſo prodigious a quantity of long roots, interwoven as it were with one another, that I continued to hope well of the ſucceſs.

Seeing, however, ſo many roots uncovered and expoſed to the air and froſt, I was tempted to fill the furrows up again, in order to preſerve them from it: but, conſidering that, by leaving the furrows open, the part of the bed in which the plants were, and which had not been plowed, would be much more expoſed to the froſt, which would then penetrate the earth through its ſurface, and through both ſides of the furrows, whereby it would be greatly divided, and perhaps meliorated more than by plowing, I preferred leaving the furrows open, and have had no cauſe to repent it.

I conſidered too, that ſuppoſing theſe roots expoſed to the air ſhould periſh, which was no more than what I might reaſonably expect; the plants had other roots on t'other ſide, which, ſtill remaining covered with earth, would be ſufficient to ſupply them with the neceſſary nouriſhment till ſpring.

After winter, the plowings were performed in proper weather, and the bed was weeded. I ſhall not repeat the detail of theſe operations, either here or in the following experiments. What I ſaid of them in the year 1753, may ſuffice, as they have not been varied ſince.

The plants I have been ſpeaking of, grew amazingly in thickneſs, height, and largeneſs of ears. They were reaped the twenty-fifth of July, and yielded five hundred and forty ounces; which is forty-

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nine times the feed, and an ounce over. The birds did no damage at all. This is after the rate of 2041 pounds, or about 93 bufhels to an arpent, which is a very great crop.

This experiment amounts to a complete demonftration of the fuperiority of the new hufbandry. It fhews, beyond all doubt, how much the earth is more perfectly tilled by it, and that this tilth is lafting, if care be taken to preferve it by good culture, performed at proper times and with judgment.

Can it be thought that a field cultivated in the old way, will, with only pulling up the ftubble, and without plowing it feveral times, even tho' it be harrowed, ever produce a crop of any corn whatever? Part of the feed might indeed fhoot, and the plants might grow fome inches high: but they would certainly perifh for want of nourifhment, which they would not be able to draw from fuch a foil, by reafon of its extreme hardnefs; and confequently they never would be able to produce any grain, which is the great object of agriculture.

It was of great importance to fhew, by an unexceptionable experiment, that lands are brought to much better tilth by the new hufbandry, than by the old. This is now completely proved; and no doubt can any longer be made, that the confequence we drew from it is equally certain; *viz. that lands fo prepared, will produce more than lands which are cultivated in the common way*. This fact, which is founded on the principles of found philofophy, is likewife confirmed by repeated experience.

The partifans of both kinds of hufbandry will do well to confider, that the great principle which we are endeavouring to inculcate, and on which almoft the whole fuccefs of the new hufbandry depends, is admitted in the old hufbandry: *viz. thoroughly to divide and loofen the earth*. This principle is fo generally received, that there is not a hufbandman who does not know that one plowing more than ordinary does his land as much good as dunging it would do. His experience has certainly taught him, that this extraordinary plowing produces him better crops: but he is not fufficiently fenfible, that of all the ways of improving his land, no one is more effectual, or lefs expenfive than this. Were the full value of it known, it would be practifed more; and every farmer would give all his lands at leaft one plowing extraordinary.

What we propofe, is therefore not a novelty capable of giving any hufbandman the leaft diflike to the new hufbandry. We all proceed

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upon the fame principle, and agree as to its effect. All of us fay, *the earth muft be well divided and thoroughly loofened:* but we differ in the manner of doing it. We propofe a method by which the ground is much better prepared than in the old way. In this confifts all the *novelty.* Whoever rightly confiders it, and compares it with the principles and experiments, will readily receive it: but he that is determined beforehand not to enter into this examination, will never enjoy the benefits of it, but will continue plodding on in the old beaten track; not from reafon, but becaufe others did fo before him.

The advantages of the new hufbandry are however fo great, that it would be doing the public an injury, not to endeavour to make them more and more known. The fitteft way to anfwer this end, feems to be, to exhort all hufbandmen to convince themfelves, by ftudying the theory of the new hufbandry, weighing the folidity of its principles, and confulting the experiments which have been already made.

Every man of common underftanding, cannot but fucceed in the practical part; and his example being imitated by others, the new hufbandry would foon become the general method.

EXPERIMENT. No. II.

N. B. *This field is marked with the fame number in the Journals of 1752 and 1753.*

For the crop of 1752, *it was fowed with* 11 *pounds* 4 *ounces of wheat, which yielded* 1041 *pounds* 12 *ounces.*

For the crop of 1753, *it was fowed with* 34 *pounds* 14 *ounces, which produced* 1575 *pounds.*

For the crop 1754, *it was fowed with* 61 *pounds* 14 *ounces, which yielded* 1820 *pounds.*

THIS field, which was to be fowed for the third time, having been brought to a good tilth by former plowings, I prepared it immediately after harveft, by giving it a plowing like that of laft year. I found I had done right in increafing the quantity of the feed the fecond year: and upon examining the plants which the earth had nourifhed, it feemed to me that it could yet bear a greater number, and that I might ftill expect a greater crop, by adding to the feed.

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Accordingly, I ſowed it the ſixteenth of Auguſt, with 61 pounds 14 ounces of very large and perfectly clean wheat, of my own growth. It was the ſame that I uſed for ſowing all my fields.

The plants made a very conſiderable progreſs after winter, and ſhot up greatly, notwithſtanding the extraordinary drought. They began to ſpindle the eighteenth of May, they bloſſomed the firſt of June; and, being ripe, I cut them down the tenth of July.

I had them threſhed a month after harveſt. They yielded 1820 pounds of perfectly clean wheat. Thus we ſee that this field produced in 1754, 245 pounds more than in 1753, and 778 pounds 4 ounces more than in 1752.

EXPERIMENT. No. III.

N. B. *This field is marked with the ſame number in the Journal of* 1753.

THIS field being now in much finer tilth than it was laſt year, would certainly have produced a greater quantity of wheat. However, I reſolved to ſow it with a foreign wheat, by way of trial. I did ſo, and it yielded me ſcarce any crop at all.

I thought it might be of great ſervice to try whether wheat of a different quality from that which we uſually cultivate, would not yield more than even wheat of the growth of our own country. At all events it was right to make this trial, tho' the wheat I uſed for it was by no means proper for ſowing in our lands. It was Sicilian wheat, the grain of which is very large and extremely hard. I ſowed it the twenty-firſt of Auguſt. It roſe well; the plants grew very fine before winter, and were extremely thick. But this wheat, being doubtleſs of a much tenderer nature than our common wheat, could not reſiſt the winter's froſt, which almoſt entirely deſtroyed it. Only a few ſtrong plants eſcaped. They grew exceeding fine, branched greatly, and produced very large ears, which contained more grains than thoſe of our own country wheat. As the plants which ſurvived the froſt were very few, I reaped only about three times the ſeed.

REMARKS on these EXPERIMENTS.

IT is by experience that we can best judge how far the advantages ascribed to the new husbandry are real. The foregoing experiments give rise to two important observations.

The first experiment shews us, that lands are brought to much better tilth by the new husbandry, and that they will consequently produce much larger crops, than in the old way. Experience proves that they have done so.

The second experiment offers us the same proofs, but upon a much larger extent of ground. We have the products of three succeeding years, and the gradation of their crops. What ought to be particularly attended to here, is, that as the internal pores of the earth became more open, the crops became more plentiful; which justifies what we said before, that the crops of the second, third, and following years, would be greater than that of the first.

It was of great consequence to establish this fact, in order to found our calculations of the products on certain and approved experiments. The following article will afford still farther proofs of this truth.

ARTICLE II.

Experiments made on lands laid out in beds, and which had borne a second crop. Reflections on these experiments.

EXPERIMENT. No. IV.

N. B. *This field is marked with the same number in the Journal of* 1753.

For the crop of 1753, *it was sowed with* 181 *pounds of wheat, which produced* 3370 *pounds.*

For the crop of 1754, *it was sowed with* 268 *pounds* 14 *ounces, which produced* 4972 *pounds* 8 *ounces.*

I Must remind the reader, that this field was sowed in 1753, half in beds, and half in equally distant rows with the drill-plough. I shall speak first of the part that was laid out in beds, which continued to be cultivated in the same manner for the crop of 1754.

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The plowings made during the year 1753, had the ſame effects on this land, that is to ſay, they looſened and divided it. It was plowed with eaſe after harveſt; and the new beds having been formed and well prepared, I ſowed them the ſeventeenth and eighteenth of Auguſt, increaſing the quantity of the ſeed to 268 pounds fourteen ounces of wheat. The plants roſe well, and throve greatly before winter; and in the ſpring they made ſtrong ſhoots.

The winter froſts, and perhaps ſome inſects too, had deſtroyed ſome plants in the rows. I ſaw plainly by this, that I had done right in increaſing the quantity of the ſeed. Though the year was dry and hot, the wheat grew to a great height, and ripened well. I reaped it between the tenth and fifteenth of July, and threſhed it out in the winter. This crop yielded me 4972 pounds 8 ounces: ſo that I had this ſecond year 1602 pounds 8 ounces more than the firſt.

I ſhall ſhorten what I have to ſay of the other half of this field, which was ſowed in equally diſtant rows for the crop of 1753. After harveſt, I made it into beds. But how ſurpriſing was the difference between the mould of theſe two parts of the ſame field, even in this ſecond year! That which had been in beds, was fine and light: but this was ſcarcely divided at all: it was full of great hard clods, many of which were obliged to be broken by hand. Though I had not much hope of its yielding any great crop, conſidering the condition it was in, I ſowed it the twenty-ninth and thirty-firſt of Auguſt.

Theſe beds were but poorly ſtocked with plants, which gathered little ſtrength before winter, and indeed always remained very weak and ſtinted, and when reaped, yielded ſtill leſs than the other half of the field had done in 1753. But if I have gained nothing by the crop, at leaſt I brought my beds into ſuch tilth, as aſſures me of a more plentiful harveſt in 1755.

EXPERIMENT. No. V.

N. B. *This field is marked with the ſame number in the journal of* 1753.

For the crop of 1753, *it was ſowed with* 139 *pounds, which produced* 2205 *pounds.*

For the crop of 1754, *it was ſowed with* 224 *pounds of wheat, which produced* 2283 *pounds.*

THE ſoil of this field was of ſuch a nature as made it more difficult to looſen, than thoſe of the experiments No. 2. and

No. 3, notwithſtanding the culture beſtowed upon it in the ſummer of 1753, which mended it greatly. Still it was not yet in the condition I could have wiſhed, when I ſowed it the eighteenth and twentieth of Auguſt, I ſowed it thicker than it had ever been before, purely on account of the badneſs of its tilth. I beſtowed upon it 224 pounds of wheat, which roſe pretty well, but afforded fewer plants than that of the ſecond experiment. They branched pretty well, and their ears were very fine. I reaped this crop the nineteenth and twentieth of July, and it yielded 2283 pounds of wheat, which is 78 pounds more than the firſt crop in 1753.

EXPERIMENT. No. VI.

N. B. *This field is marked with the ſame number in the journal of 1753.*

For the crop of 1753, *it was ſowed with* 45 *pounds of wheat, which produced* 724 *pounds.*

For the crop of 1754, *it was ſowed with* 82 *pounds of wheat, which produced* 798 *pounds.*

WHAT I ſaid of the foregoing experiment, may likewiſe ſerve for this. All the circumſtances were alike, except that this field was ſowed a few days later, *viz.* the twenty-ſeventh of Auguſt. It was reaped the nineteenth of July, and yielded 798 pounds, which is 74 pounds more than in 1753.

EXPERIMENT, No. VII.

N. B. *This field is marked with the ſame number in the journal of 1753.*

For the crop of 1753, *it was ſowed, as well in that part of it which was made into beds, as in that which was ſowed in equally diſtant rows, with* 412 *pounds of wheat, which produced* 2646 *pounds.*

For the crop of 1754, *the whole field was made into beds, and ſowed with* 360 *pounds, which produced* 2467 *pounds.*

IT muſt be remembered that one half of this field had borne a firſt crop, and the other a ſecond. From what I have already ſaid, it will be preſumed that the mould of the new beds was not in ſo good condition as that of the other beds: conſequently the former could not be expected to yield ſo good a crop.

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This field was fowed the twenty-firft and twenty-eighth of Auguft. Its whole extent took up 360 pounds of wheat, which yielded a crop of 2467 pounds. At firft fight, it feems to have yielded lefs now, than in 1753: but it muft be obferved, that the beds of this field were of two different ages: thofe which now bore their fecond crop, yielded more than in 1753; but as the fheaves were not collected feparately, I cannot tell exactly the difference of their produce.

Reflections on the experiments contained in this article.

I Have now given an account of four fields, which produced their fecond crops in 1754, all of which were greater than thofe of 1753, and efpecially that of the fourth experiment. I am fully fatisfied that their produce was proportioned to the preparation of the foil. This obfervation fhews of what confequence it is to divide and loofen the earth as much as poffible, by deep plowing and thorough hoeing, in order to bring it to a perfect tilth; which may certainly be done, and that in fhort time, by the means which I fhall point out in the following article.

Neither our intereft, nor the knowledge we would acquire of the products which the new hufbandry is capable of yielding, fuffer us to reft fatisfied with knowing, for example, what the crop of thefe four fields was the fecond year, and looking upon that as the moft they will ever produce. We ought likewife to examine whether their crop was not diminifhed by caufes which we can account for, and which we may reafonably hope will not take place in other years.

By this examination we fhall find, that the year was not a good one for great crops of wheat. There was not rain enough: the corn grew thin, and yielded but few fheaves. The ears were indeed full of grain, but the quantity was not fufficient to make amends for the thinnefs of the crop.

The wheat was *rufted* in autumn; and though this diftemper fhewed itfelf in that feafon, in which I think it does the plants leaft hurt, yet it prevented their branching, fo much as they would otherwife have done, the next fpring. I obferved exactly, that the thinneft places were thofe where the *ruft* had prevailed moft. Laftly, the frofts which happened in March, did great damage to the wheat. It is therefore not to be wondered at that the crop was not greater. I hope, and, I flatter myfelf, not without foundation, that the fame fields will produce better crops in years exempted from ſuch accidents.

I do not pretend that the new huſbandry can ſecure corn from the effects of all theſe accidents: but I have experienced that it has ſuffered leſs from the intemperature of the ſeaſons, than that which has been ſowed in the common way: for inſtance, it will ſuffer leſs by a great drought, or even not be at all affected by it, if dews fall, which penetrate the well-looſened earth; as I have conſtantly obſerved: and beſides this, the roots of the corn in the new way, being much longer, will extend to a conſiderably greater depth in ground that has been plowed deeper; and will find a moiſture there, which corn in the common way is deprived of.

ARTICLE III.

Experiments made on lands laid out in beds which had borne a firſt crop: with an account of the manner in which they were tilled, to prepare them for ſowing. Remarks on theſe experiments.

THE firſt crops of all my fields laid out in beds, have hitherto been but ſmall. I eaſily diſcovered that this was owing to two principal cauſes, independent of the intemperature of the ſeaſons. The firſt was, that I ſowed too little ſeed at firſt, and that the quantity was not ſufficient to bear the accidents which befel my wheat, without being conſiderably diminiſhed thereby. This I remedied afterwards, by increaſing the quantity of the ſeed; which I have continued to do by little and little, from year to year, in proportion to the condition and quality of my land.

The ſecond cauſe was the bad condition of my lands, which could not be ſufficiently looſened and divided in ſo ſhort a time, and therefore did not afford the plants the quantity of nouriſhment neceſſary to enable them to produce plenty of grain.

I was in hopes, that by continuing my plowings, I ſhould have better ſucceſs the following years: that is to ſay, that I ſhould bring my land to a looſer ſtate, and that if I gained that point, the crops would certainly be greater afterwards.

Encouraged by this expectation, and provided with my plough and cultivators, I made no doubt of ſucceeding. To this end, I reſolved to multiply the plowings: and certainly no one ought ever to heſitate ſo to do, even in the common huſbandry; ſo great have been the effects produced thereby.

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" I have often reflected on this paſſage in Mr. Du Hamel's treatiſe of the culture of lands: *One of the Preſident Monteſquieu's farmers reaped a great crop of Spaniſh wheat, from his farm near Clairac, at a time when all his neighbours crops were very bad. The preſident aſked him what he had done to have ſuch extraordinary ſucceſs. The farmer anſwered, that he had plowed his ground eleven times betwixt ſowing and harveſt; and that by this means it had reaped the benefit of all the rains, dews, fogs, &c. whilſt his neighbours lands were not at all bettered by them, on account of a dry hard kind of cruſt, which grew over their grounds, for want of plowing. This obſervation agrees perfectly with the principles on which the new huſbandry is founded.*

This ſhews us that an active, intelligent, and induſtrious farmer, will always reap the fruit of his labour and expence. But without pretending to ſay that land ought to be plowed quite ſo many times, we learn from this example, that it would be greatly for the public good, to plow it oftener than it generally is.

I multiplied my plowings, in the ſpring, and till ſeed time. I gave my land ſix plowings in all: but I aſcribe the great benefit I received, chiefly to the manner in which thoſe plowings were performed, and to which I beg the reader ſeriouſly to attend.

After the beds were formed, my method was this. I changed their poſition by removing the middle of the beds to the place where the great furrow in the middle of the alley was; or, to make myſelf better underſtood, I performed the ſame plowing that we do after the firſt crop is reaped.

This operation is of ſuch importance, that it requires my being ſtill more explicit. I ſhall therefore relate the whole preparation that I gave my land. In the firſt place, I plowed it twice, as deep as poſſibly I could, in broad lands. The beds were formed at the third plowing. I afterwards gave a fourth plowing, to raiſe them ſtill higher, by opening the firſt furrow in the middle or higheſt part of the beds, and turning the earth on both ſides up againſt that middle, by which means the beds were arched very high, and a great furrow was left in the middle of the alleys. I went farther yet; and this I ought to reckon as a ſeventh operation: I cut the great furrow in the middle of the alley ſtill deeper, with one turn of my cultivator with two mould boards.

The beds thus prepared, were certainly in good order to be ſowed: I ne-

I never had them in ſo good condition before: but I was willing to go ſtill farther; and that for the following reaſon.

I had obſerved that there is always a greater depth of fine mould in the middle of the bed, when it is placed in the ſpace before occupied by the great furrow in the middle of the alley. I had not diſpoſed my beds in that manner till the ſecond year.

I therefore thought it adviſeable to change the place of the beds. I did ſo, at the fifth plowing, by filling up the great furrow, which now became the middle of the new bed. The earth being in a very looſe ſtate, a great deal of it was heaped up by each turn of the plough, with eaſe to the horſes, and with ſpeed. The middle of the beds was raiſed as much as might have been thought neceſſary: but I raiſed it ſtill higher, by the ſixth and laſt plowing, by cutting the firſt furrow in the middle of the bed, and turning the earth up from right and left towards it.

By theſe plowings, the mould of the beds will be admirably well prepared even the firſt year, and the ſeed ſowed therein will not fail to vegetate very abundantly. It is by this means that I have brought the middle of my beds to the depth of 15 or 18 inches of fine looſe mould, in which the perpendicular roots of the plants extend themſelves and multiply eaſily, and find plenty of nouriſhment, which they afterwards tranſmit to the plants themſelves.

I ſhall mention farther, as a proof of the fineneſs to which theſe plowings brought the earth, that I was not obliged to harrow my beds, before I ſowed them.

Some may perhaps object, that all this requires much labour, great trouble, and conſiderable expence: and how, will it be added, can one find time for ſo many plowings?

To this I anſwer: firſt, that allowing all this to be true, the crop will make very ample amends for it. What follows will eſtabliſh this truth beyond all doubt.

Secondly, that this labour ought not to diſcourage any one. The four firſt plowings are abſolutely neceſſary, as all will agree; and the fifth and ſixth are performed with ſuch eaſe, and in ſo much leſs time than the common plowings, and eſpecially the laſt, for which one horſe will generally be ſufficient, that it will eaſily be perceived I do not propoſe a thing either too difficult or too expenſive to execute.

The fields of the three experiments of this article, were prepared in the manner I have now related.

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EXPERIMENT, No. VIII.

THE foil of this field is very good and ftrong. Its extent is 1300 toifes. I made the beds about fix feet wide; and each bed was fowed with two turns of the drill plough, which were to make fix rows: but the difficulty of guiding the plough fo as to keep the three laft rows exactly parallel to the three firft, was fo great, that the two middle rows were frequently jumbled together, fo that there were in fact but five rows in fome places. The fpace that remained between the outer row of one bed and the outer row of the next bed, left an alley wide enough to be plowed. I muft obferve that our farmers hereabouts liked this way of fowing much better than the firft, in which I likewife made the beds fix feet wide; and fowed them with only three rows.

I fowed each row a little thinner than in the former experiments: but as there were more of them in each bed, they would of courfe require a greater quantity of feed. This field was fowed the twenty-feventh of Auguft, with 76 pounds 8 ounces of wheat.

All my plants were equally fine till winter, and fhot up with great vigor in the fpring. They grew exceeding high, branched abundantly, and produced very large ears, among which there was but little difference. This crop was reaped the feventh of July, and yielded 1462 pounds of wheat.

This produce made me ample amends for the labour I had beftowed upon the ground. It is after the rate of about 1500 pounds, or 72 bufhels to an arpent.

EXPERIMENT, No. IX.

THIS field is of a very indifferent quality, and had hitherto yielded but fmall crops. Its extent is 5813 toifes 12 feet. It was fowed the feventh and eighth of Auguft, in the fame manner as the former, with 249 pounds 12 ounces of wheat.

The young plants fhot up as thick, and looked as ftrong and of as good a colour, as thofe of the foregoing experiment: but the ruft took them all in October and November, and their blades, which were of the fineft green before, turned yellow, and perfectly covered the ground with the powder of this ruft. My plants fuffered greatly by this accident. They branched imperfectly, and confequently grew

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very thin. Their ſtalks were, however, long, and bore fine ears. They were reaped the 8th of July, and yielded 2925 pounds of wheat.

EXPERIMENT, No. X.

THE ſoil of this field is rather inferior, than equal to that of the field we ſpoke of laſt, whoſe fate it likewiſe ſuffered in every reſpect. The young plants were extremely fine, and, in October and November, they were ruſted almoſt as much as the others. This field contains 4919 toiſes. As I thought this land inferior to the other, I ſowed it thicker; uſing to this end 294 pounds of wheat. It was ſowed the 8th, 17th, and 28th of Auguſt; not being able to do it in any three days running. The crop yielded 3055 pounds.

Remarks on theſe Experiments.

I Have now been able to obtain better crops, even the firſt year, by the new huſbandry, than any I ever had before. I think there can be no doubt but that this ſucceſs is owing firſt, and chiefly, to the better preparation of the ground; and ſecondly, to the proper increaſe of the ſeed. Upon the whole, I am inclined to think, that the ſowing each bed with two turns of the drill-plough, increaſed the crop. But of that I ſay no more at preſent, as I intend to treat expreſly of it in the eighth article.

All my obſervarions ſhew how much I am convinced of the importance of bringing the earth to a fine looſe ſtate: nor can I recommend it too ſtrongly. I have ſenſibly experienced the good effects of it in all my lands, and particularly in thoſe of the ninth and tenth experiments; for though theſe fields are but of an indifferent quality, they have produced plants equal to thoſe of my very beſt lands.

After what I have now ſaid, no one will be ſurpriſed that almoſt all my firſt crops were but ſmall, ſince moſt of the grounds were ſown after a ſingle plowing, which was not ſufficient to prepare them properly. I was indeed well appriſed of this defect at my firſt ſetting out: but all I then aimed at was, to lay all my fields into beds as ſoon as poſſible; being thoroughly ſatisfied that it would not be long after, before I ſhould be able to bring them to a proper tilth, with great eaſe and little coſt.

Theſe three experiments, not only ſhew us how to conduct our works more profitably hereafter; but they likewiſe diſcover a new

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advantage in this hufbandry, which indeed I fufpected from my very firft experiments. It is of importance to take notice of it here.

All the experiments that have been made by different perfons, and in different places, have fhewn us that wheat cultivated in the new way is very little apt to lodge; that the great ftrength of its ftalk fupports it, and that it refifts the force of the wind much better than common wheat, the ftalks of which almoft always give way in ftormy weather.

It muft however be owned, that the wheat of the new culture is not abfolutely able to refift extremely violent winds accompanied with great rain. But would any one have expected that the accident I am going to fpeak of, far from hurting the wheat, feemed to me to be of great fervice to it, particularly in very rainy years, or when cold dews fall towards the time of its ripening?

I obferved, in the account of my experiments in 1752, that my wheat was not lodged; but that fome of it was bent, without fuffering any damage thereby. I added, *that I imagined it might be of fervice to the wheat not to remain always in an exactly perpendicular fituation.* I purpofed watching clofely what effect the fituation of this would have. I could not be fatisfied in this in 1753; but the year 1754 furnifhed me with obfervations, and afforded me advantages with refpect to the quality of wheat, which it is always of very great fervice to know.

Wheat grows up and fhoots pretty perpendicularly: it does not alter this direction, unlefs it meets with fome obftacle: the moft formidable is a violent wind, accompanied with great and heavy rains which lodge it. Every one knows that when wheat is lodged foon after it has done bloffoming, it yields fcarce any grain, and that what it does yield is very fmall and fhrivelled, and contains very little flour: a manifeft, and oftentimes very confiderable lofs.

The wheat that is only bent, continues to grow in that fituation: its ears fwell and fill equally with grain to the very point, abounding plentifully with good and very nourifhing flour. Thus no lofs is fuftained in this cafe; and this inclined fituation of the ftalk does not at all interrupt the functions of the nutritive juices, as in wheat that is lodged. The growth of the plants in this fituation, proves plainly that their vegetation is not ftopt.

This bending of the ftalks no way hinders a fkilful and careful hufbandman from giving another plowing, if it be neceffary. I had it done in the field of the eighth experiment, without hurting or deſtroying a ſingle ear.

The three fields on which the experiments mentioned in this article were made, have all their beds in the ſame direction, *viz.* from Eaſt to Weſt, and lie ſomewhat ſloping toward the Weſt. Soon after the wheat had done bloſſoming, a ſtrong ſouth wind blew for ſome hours, accompanied with a heavy rain, which made all the wheat of theſe three fields incline towards the north. It remained in this ſituation till harveſt, and the ſtalks grew ſo crooked that the points of the ears turned down towards the ground: they remained thus ſuſpended, by the ſtrength of the ſtalks, which ſeemed even to increaſe: for I did not find that they bent any more, though the weight of the ear increaſed as the grain grew riper.

In this ſituation, this wheat continued to proſper: the ears filled with grain to the very point: they grew as large and heavy as thoſe of the other fields; and had beſides the advantage of being of a finer colour. This quality helps corn to ſell ſooner and more eaſily, becauſe the buyer judges by his ſight more than by his other ſenſes. It is of conſequence in all ſorts of goods, to catch the eye; but there is no fear of its deceiving one in the choice of wheat: the good colour of the grain is always a ſure ſign of its ſoundneſs, and invites the purchaſer to buy it with confidence.

Since then there is no fear that any damage will ariſe from wheat's being bent, there is no cauſe to repine or be uneaſy at ſeeing it in that ſituation. But, beſides what I have been ſaying, I muſt now offer ſome reaſons why I think it may perhaps be better for wheat to be bent and curved in that manner, than for it to grow almoſt quite upright.

Let us conſider what effect rain, the moiſture of the air, and dews have upon the ears of corn in both theſe ſituations. When the ears ſtand upright, and almoſt perpendicular, they retain a great deal of wet in rainy and dewy weather. This wet inſinuates itſelf very eaſily between the huſks that cover the grain, and gets even into the inſide of them. This water, thus got within them, remains there, and does not evaporate ſo eaſily as that which is only on the outer ſurface of the huſks, which the motion of the air, or the ſun, diſſipates in a ſhort time.

It may happen too, but I ſhall not give it as a fact which I have yet ſufficiently obſerved, *that the water which has penetrated between the huſks, touches immediately the grain itſelf.* Now this moiſture

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all around it, in whatever manner it gets there, muſt ſurely be very prejudicial to the grain; and the longer it ſtays there, the more hurt it muſt do. We have ſeen ſuch continual rains in ſome years, that, for ſeveral days together, even the outſide of the ears could not be wiped dry, but have remained wet ſo long that the corn has ſprouted while it ſtood upon the ground. But, without ſuppoſing the miſchief to be always ſo great, wet, by remaining too long upon the grain, may, in ſome meaſure, ruſt it a little, as it ruſts ſtraw while ſtanding. I have ſeen this happen; though indeed but ſeldom.

The imperfection that is often found in the quality of the grains, and their ſometimes leſs pleaſing taſte, may, with great probability, be imputed to this caſe: and perhaps it may be found upon ſtricter inquiries than thoſe I have hitherto been able to make, that the moiſture too long retained round the grain, towards the latter end of its growth, and particularly that of cold dews, is the real cauſe of the fatal and ſudden changes which often befall wheat in grain, a little before harveſt, and rob us of the beſt part of a crop which was juſt before thought to be quite out of danger.

When the wheat is inclined, its ſtalks bent downwards arch-wiſe, and the point of the ears turned down towards the ground, it is plain that no wet, either of rain or dews, can ſo eaſily get at the grain, and that only the outer ſurface of the huſks will be immediately touched by it: the water, not being able in this ſituation to glide in between the interſtices of the huſks, will drip down from one huſk to another till it comes to the point, and then will fall to the ground. Theſe huſks are ſoon dried again; and the ears which grow in this manner are much leſs expoſed to the conſequences of the wet, than thoſe which remain in a perpendicular ſituation; and conſequently their grain ought to be better conditioned.

This advantage can be enjoyed only in the new huſbandry: for in the old way, the wheat is either lodged quite flat, or ſtands quite upright: ſcarce any of its ſtalks are ſtrong enough to ſupport the ſmall weight of the ear, when bent and inclined towards the earth.

ARTICLE IV.

Experiments made on lands laid out in beds, which have borne a firſt and ſecond crop; together with ſome intereſting obſervations.

EXPERIMENT. No. XI.

IN the Journal of 1753, I gave an account of the experiments which a perſon had made on about 23 arpents, laid out in beds of about ſix feet wide, and which did not meet with the deſired ſucceſs. I added, that the ſame perſon, perſuaded nevertheleſs of the advantages of this culture, had prepared twenty arpents more in the ſame manner, and that all of them were ſowed for the crop of 1754.

All this ground was plowed with care, and part of it was ſowed earlier than the year before. Some little addition was likewiſe made to the quantity of the ſeed. The plants in general roſe extremely well, and were ſtrong and healthy before winter, in proportion to the time of their being ſown, and to the quality and condition of the land.

Such a beginning gave room to hope that theſe fields would yield a pretty good crop: but the winter ruined all; and ſcarce any thing was reaped from ſo large an extent of ground.

OBSERVATIONS on this EXPERIMENT.

IT would have been unfair in me not to mention this experiment, tho' it anſwered ſo badly. The reader may be ſurpriſed at firſt, to ſee ſo great a contraſt between this and my own experiments, in which, notwithſtanding the intemperature of the ſeaſons, and other accidents, he finds the crops increaſe, as the land becomes better tilled according to the principles of the new huſbandry. This increaſe was what we foretold would happen: but the field we are now ſpeaking of, produced leſs the ſecond year than it did the firſt, tho' even that was very little.

There muſt then neceſſarily have been ſome differences between theſe fields, to which this great diſparity of their crops was owing. Theſe differences doubtleſs were, either in the quality of the ſoils, the preparation of them, their expoſition, the quantity of the ſeed, the

the accidents that befel them, which might be greater or leſs, in ſome than in others; or, in ſhort, many other cauſes capable of helping or hurting the crop: for otherwiſe, ſuppoſing all theſe things to be equal, or nearly ſo, the difference in the crops could not have been great.

Not to impute the bad ſucceſs of this laſt experiment, too lightly to the new huſbandry, we ought, in juſtice, to examine whether it might not be owing to ſome other cauſe, and whether there may not be room to hope for better ſucceſs another time.

Theſe fields, without being all exactly of the ſame quality, are generally reputed in the country *cold and ſtiff lands and very apt to grow hard.* Such lands will certainly require more time, more patience, and more perſeverance, to bring them to any degree of tilth: more plowings will be neceſſary, and thoſe plowings muſt be given in the moſt proper ſeaſons. By continuing to ſtir them well, their hardneſs and reſiſtance will be overcome, their pores will be opened and multiplied, and plants will then thrive in them as well as in the beſt of ſoils.

All lands ought to be treated according to their reſpective qualities. There is great reaſon to believe that this field, when prepared as thoſe of the experiments No. VIII. IX. and X. were, will hereafter produce great plenty of corn. What I now ſay, is not mere ſuppoſition or ſurmiſe. Repeated experiments, the effects of which have conſtantly been the ſame, have taught me, and I can ſafely affirm, that extremely bad lands, which could not ſo much as yield a crop that would pay the expence of tilling them, have been rendered good and fertile merely by plowing, and without the aſſtance of any manure.

This is a ſtriking truth. It was what firſt determined me to practiſe the new huſbandry; and therefore it was of conſequence to me to be certain of it. To this end, I reſolved to make a trial on a ſmall ſpot of ground, which I knew to be incapable of producing any thing.

Some years before, I had dug away the earth three feet deep, from a ſpace of 60 ſquare toiſes: nothing remained in it but a cloſe white clay, fit for potters uſe. This ſpot, thus circumſtanced, ſeemed to me a proper one for my experiment. As the ſpace was too ſmall for the plough to work in, I made uſe of the ſpade and hoe. It was made into beds, which were afterwards ſowed with wheat, and the ſpaces between them frequently ſtirred. The firſt year, my plants

plants were very poor, and branched into only two, three, or four ſtalks a-piece. The ſecond year, they did much better; and the third year, they were as large and fine as any my garden could have produced. This ſpot ſtill continues to produce equally well.

We have here a remarkable inſtance, of what may be done by ſufficiently pulveriſing the earth: that which I am ſpeaking of, is now like mould; and, which is very remarkable, it has loſt its former white colour, and is now black. Let us but do the ſame with any of our bad lands, and perſevere in plowing and ſtirring them a ſufficient time: the ſucceſs will not be doubtful.

But to return to the ſubject of this article. Some of the fields we were ſpeaking of, are ſurrounded by, or border upon woods. This ſituation is far from being good, and it ſeldom happens but that ſuch a neighbourhood does great injury to the crops.

I could likewiſe have wiſhed, that a larger quantity of ſeed had been employed to ſow theſe fields. The loſs occaſioned by the froſt might have been leſſened thereby; as it may be preſumed that a greater number of plants would have eſcaped, if they had been thicker in the places where all of them were not intirely deſtroyed.

We obſerved before, that the young plants were in a fine condition before winter, and that they promiſed well; but the ſeverity of the froſts, doubtleſs too great for the condition and ſituation of theſe lands, did an irreparable injury to almoſt all theſe fields.

I examined the greateſt part of them in the beginning of ſpring. Of all thoſe which I ſaw, I found but one ſpot of three or four arpents, of which the earth was in the condition it ought to be, that is to ſay, well ſtirred and broken, ſupple, light, and penetrable. Too few plants were left in this good ſpot: large ſpaces were quite empty in moſt of the rows: but thoſe that did reſiſt, grew very fine in the ſummer, branched extremely well, and bore fine ears.

By this one might gueſs what theſe lands were capable of. My opinion is, that, in other years free from ſuch accidents, the rows will remain well ſtocked with plants, which, finding an equal plenty of nouriſhment, will be nearly of equal ſtrength and beauty in every part, and, all together, will produce a conſiderable quantity of corn.

The

The other fields were infinitely worſe treated.* Every thing was deſtroyed for ſeveral arpents together. The plants were rooted up by the ſtrength of the froſt, and lay ſcattered upon the ground all along the rows, withered and unable to recover the leaſt vigour. Theſe are the only fields laid out in beds, in which I have ſeen this extraordinary accident: not a plant was rooted up any where elſe. It is very difficult not to ſuſpect that there muſt have been ſome fault in the ſowing, and that the ſower did not perhaps bury the ſeed deep enough. The roots which were too near the ſurface of the earth, were nipped by the froſt. They muſt have been ſo, ſuppoſing them to be but about two inches deep. We likewiſe know, with certainty, that if the ſeed had been ſowed in good time, the plants would have had roots above ſix inches long; and that ſuch roots would have ſecured them from being killed by the froſt. There is room therefore to believe that the ſeed was not buried deep enough.

But even ſuppoſing the plants not to have been deſtroyed, I doubt whether they would have yielded a good crop, becauſe the ground, eſpecially that of the partitions between the rows, was extremely hard and cloſe, and therefore quite unfit to ſupply the plants with the nouriſhment they would have wanted.

This experiment required theſe remarks: many more might be added; but theſe are ſufficient to ſhew that ſome lands require a double portion of care and labour.

EXPERIMENT, No. XII.

THE account of the ninth experiment in 1753, promiſed better ſucceſs the next year. The whole culture was performed by the ſame perſon, with great care and extraordinary judgment, on two fields, containing about eight arpents. One of theſe fields is much better than the other: the beds were about ſix feet wide: one half of the field, the ſoil of which was inferior to that of the other, was dunged; but not above a third part as much as it would have been in the common way. The ſoil of this field is very ſtiff. It had

* All theſe obſervations, ſays M. du Hamel, ſhew that this land is of the nature of thoſe which ſwell greatly in hard froſts, and, ſubſiding again upon a thaw, leave the roots of plants quite bare upon their ſurface. In whatever manner they are cultivated, they ſeldom produce any thing if the winter is ſevere. The beſt way is to ſow them with ſpring corn.

had not been plowed for 15 or 20 years, and was not yet ſufficiently looſened and divided.

It was ſowed early: the plants roſe very well, but were greatly hurt by the froſt, excepting thoſe which the dung preſerved. The ſame thing happened to the beds which were ſowed with ſix rows.

The ſoil of the other field is fatter and of a better quality. The winter did it little hurt. The plants throve by the culture that was given them, but leſs than was expected; owing, as is ſuppoſed, to the great drought of the ſeaſon. Theſe two fields produced, however, about 7000 pounds weight of wheat; which is extremely well, eſpecially for a firſt crop.

Theſe two fields have given us room to make two reflections. Firſt, that *the earth muſt be well prepared, without which the plants are not able to extend their roots to the plowed part of the alleys.* Secondly, that *in dry ſprings, the plants of wheat preſerve one another mutually from the drought, for which reaſon it is proper to ſow ſomewhat more than would otherwiſe be neceſſary.*

The ſame culture is now practiſed for the year 1755, and is extended to about twelve arpents more.

EXPERIMENT. No. XIII.

I Mention this experiment on account of the faults the huſbandman committed, that others may take care to avoid them. About two arpents and an half of pretty well plowed land made into beds, produced only about 780 pounds of wheat the ſecond year.

The reaſons why this crop was ſo ſcanty, are evident. In the firſt place, too little ſeed was ſowed; there ought to have been three times the quantity. Secondly, the beds were of an exceſſive breadth, all of them being eight or nine feet wide, and ſowed with only three rows. By this means, great part of the ground was loſt; which ought to be carefully avoided.

The plowings too were made in a very ſlovenly manner: the huſbandman gave them, not when they were neceſſary, but when it ſuited his convenience. The reaſon was, that he was prejudiced againſt the new huſbandry, and did not deſire to ſee it ſucceed.

ARTICLE V.

Experiments made by ſeveral Lovers of Agriculture, on lands ſown in equally diſtant rows with the drill-plough.

SOME of the principles of the new huſbandry, have been adopted in this way of ſowing; and even the common plowing, is now performed with more care than it was before the great advantage of thoroughly dividing and breaking the earth was ſo well known. This method of ſowing the land all over in equally diſtant rows, being, in appearance, eaſier and more ſimple than forming it into beds, has now a great number of partiſans: and, indeed, the lands which have been ſown in that manner, have yielded much better crops than the fields cultivated in the old way.

EXPERIMENT. No. XIV.

IT is pretty generally the cuſtom about Geneva, if the land is good, to ſow it in April, over the wheat, with clover ſeed, which yields a crop the next year. Agreable to this cuſtom, a field of about two arpents and an half, was ſowed with clover in April 1752. In 1753 it yielded two crops of clover, after which the owner of the ground gave it three good plowings in the common way. The clods which the plough had left, were afterwards broken by hand, before the field was ſowed; for it was reſolved to ſpare no pains to give it a good preparation.

About 630 pounds of wheat uſed generally to be employed to ſow this field: but it was now ſowed, the fourteenth of September, with only 315 pounds. The earth was extremely dry, and the weather very hot, which it continued to be for ten days longer; circumſtances which ought to be attended to, and which it will be proper the reader ſhould remember when he comes to the continuation of this experiment in the ſeventh article.

This field was plentifully ſtocked with plants. They yielded 2926 pounds of wheat. In proportion to the produce of the other fields of the ſame farm, this would have yielded, at moſt, only between 18 and 1900 pounds: conſequently here is a gain of about 1026 pounds, beſides 315 pounds ſaved in the ſeed, which makes in all a profit of 1341 pounds.

EXPERIMENT. No. XV.

THE fame perfon who made the experiments, No. VII. in 1752, and No. X. and XI. in 1753, continued them in comparifon with the old hufbandry. They anfwered as before, and the fame advantages were again confirmed. A detail of the particulars would be needlefs. I fhall only add, that barley, with which the experiment was likewife tried, anfwered much beyond any thing that was expected, and yielded a prodigious crop.

The farmer, convinced by fuch fuccefs, of the fuperiority of the new hufbandry over the old, immediately begged his landlord to make no more experiments by way of comparifon, but to let him fow all his lands with the drill-plough.

EXPERIMENT. No. XVI.

THIS experiment was made in the fame farm where the XIIIth and XIVth were made in 1753. All the lands were very well prepared, and fowed with the drill-plough.

One of thefe fields, containing about three arpents and an half, which ufed to require 880 pounds of feed, was now fowed with 315 pounds. The plants were extremely fine, both before and after winter, and, when reaped, yielded 4940 pounds of wheat. If it had been fowed in the common way, it could not have been expected to yield above 2900 or 3000 pounds: confequently it now produced 1940 pounds more; to which if we add 565 faved in the feed, we fhall have 2505 pounds of wheat more by the new, than would have been obtained by the old hufbandry.

Another field, of an inferior quality, the extent of which is near feven arpents, ufed in the old way to be fowed with 1764 pounds of wheat, and was now fowed with only 819 pounds, which produced about 5720 pounds. Though the difference in the goodnefs of the lands is confiderable, yet the drill-plough ftill maintains its fuperiority: for, if this field had been fowed in the common way, it would have been thought to have produced an exceeding good crop, if it had yielded between 5200 and 5300 pounds, though that would have been 420 pounds lefs than this, which added to the 935 pounds faved in the feed, make this crop 1355 pounds greater than it would have been in the old way.

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A ſmall ſpot, of about half an arpent, which uſed commonly to be ſowed with 157 pounds of wheat, was ſowed with 63 pounds, and produced about 430 pounds. This is nearly the ſame proportion as the foregoing experiment.

Theſe fields, being ſome better than others, may ſerve to ſhew what may be expected from lands of different qualities.

A piece of ground of five and twenty arpents was likewiſe plowed with care. This, to have ſowed it in the old way, would have required about 6550 pounds of ſeed, which would have yielded at moſt 20000 weight. I even think I over-rate it in this.

Theſe 25 arpents were ſowed with 2772 pounds of wheat. Here is, in the firſt place, a ſaving of 3778 pounds in the ſeed, which is a very conſiderable object. The whole crop yielded about 19000 pounds, which added to the 3778 pounds ſaved in the ſeed, make 22778 pounds. The profit therefore is 2278 pounds more in the new way, than in the old.

To ſet this experiment in a yet clearer light, I ſhall add, that the ſheaves were ſtrong, the ſtraw fine, the grain very clean and plump, and that half theſe fields had ſuffered conſiderably by the froſts in March.

The produce of a few detached pieces of land, might not have been ſufficient to perſuade the generality of mankind, ſo much as to adopt even this change, which conſiſts ſolely in the manner of ſowing the land. They might ſtill think it imprudent to give up a certain profit for an uncertain one. It is fit therefore that they ſhould ſee by the management of a whole farm, that this huſbandry may be practiſed to very great advantage. This we ſhall ſhew in the following article.

EXPERIMENT, No. XVII.

THIS experiment, which is a very conſiderable one, was executed on the ſame perſon's lands, who made the experiment No. 12 in 1753. All the lands were ſowed with the drill-plough. They were plowed four times, and a ſmall part of the whole was dunged. I cannot enter into all the details of this operation; but the general reſults, which we ſhall give, will be ſufficient.

The lands we are ſpeaking of compoſe three farms, ſituated in three different villages, about a mile and a half diſtant from each other. Theſe lands are of different qualities; ſome ſtiff, others pretty light, others of a middling quality, and but little ſtony.

About 85 arpents were cultivated in the first farm, 32 in the second, and 32 likewise in the third. In all 149 arpents.

		Pounds.	
The quantity of seed used in the common way, was,	For the first farm, sowed in August and September . . .	21420	of wheat.
	For the second farm, sowed between the 1st and 15th of October	8190	
	For the third farm, sowed between the 20th and 30th of October . . .	8190	
	In all . . .	37800	

		Pounds.	
The quantity of seed sowed with the drill-plough, was,	For the first farm . . .	8190	of wheat.
	For the second farm . .	3276	
	For the third farm . . .	3276	
	In all . . .	14742	
	Saved in the seed . .	23058	
	Total . .	37800	

		Pounds.	
Crops in 1754.	First farm	70200	of wheat.
	Second farm	22750	
	Third farm . . . . :	15210	
	Total crop . . .	108160	
	To which must be added the saving in the seed	23058	
	The whole profit is . . lb.	131218	of wheat.

It will be right to see now what the same extent of land might possibly have produced, if it had been cultivated in the old way. This can indeed only be guessed at, and I chuse therein to favour the old husbandry. According to the general run of this year's crops, these three farms would have produced at most about 95000 or 100000 pounds of wheat; which would consequently have been 31218 pounds short of what they yielded in the new husbandry.

This way of stating the account of the produce of both methods, is a fair one. *The saving in the seed is always to be reckoned.* But I have perceived, by the questions which several persons have asked me with regard to accounts thus stated, that they were not clearly understood. I shall therefore throw them into another form, which has been thought clearer, but of which the results will still be the same.

We will reckon only the real and actual produce, and then substract the seed: the remainder will consequently be the neat produce.

NEW METHOD.

Total produce	108160 lb.
To be deducted for the seed	14742 lb.
Neat produce . . .	93418 lb.

OLD METHOD.

Total produce	100000 lb.
To be deducted for the seed	37800 lb.
Neat produce . . .	62200 lb.
Therefore the new method produced more than the old would have done . .	31218 lb.
Proof	93418 lb.

Which result is the same as that of the other comparison.

Are not such advantages well worthy the attention of every one concerned in husbandry?

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EXPERIMENT, No. XVIII.

WE saw by the 15th experiment in 1753, that the fields which I had sowed, with the drill plough, in equally distant rows, yielded very little corn. I mentioned the causes, which I knew. I have not yet had time to form them into beds, by which means I shall certainly remedy the cohesion of the soil, and without which those lands will never yield any other than poor crops, as they have almost always done whilst cultivated in the old way, which is infinitely less fit for lands that require a great deal of stirring, than for such as are naturally fruitful.

I hope I shall be able to begin next year to practise the new husbandry in this farm. I should have done it before now, if I could have made any stay there: but as I could not, I have only continued to sow it with the drill-plough in equally distant rows.

I shall mention another small farm, on which no dung or any other kind of manure was used, though its lands, at least the greatest part of them, are but very indifferent.

I sowed these lands towards the end of August and the beginning of September, in pretty hot and dry weather. The whole extent of this little farm is between 18 and 19 arpents, which used to take up 4662 pounds of seed: but only 1950 pounds were employed now.

Some places looked well enough: but in general the wheat came up thin. I was however very well satisfied with my crop, which yielded about 13000 weight of extreme fine wheat, so clean that it wanted no sifting. If I had not sowed with the drill-plough, I should scarcely have reaped more than barely the seed: for that was the case with all my neighbours, who had only about their seed and half as much over; and many of their crops yielded still less. It is not to be supposed that I should have fared better than them, if I had followed the old way, as they did.

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ARTICLE VI.

Summary accounts of the products of several pieces of land sowed in equally distant rows with the drill-plough.

EXPERIMENT, No. XIX.

AS nothing but a great number of experiments, repeated under different circumstances and in different places, can convince many of the advantages of the new husbandry; I am the more readily induced to mention all that have come to my knowledge; though there are among them several of which I have not been able to get so particular a detail as I could have wished: all that has been told me in relation to many of them being, that those who made them were well satisfied with the crops they had obtained by means of the drill-plough, and that they intended to continue using it: but the following experiments will merit the reader's attention.

The lands I am going to speak of, are situated in a space of 9 or 10 square leagues; and there are great differences in their qualities and situations: they were not all plowed with equal care: some of them were dunged, and others were not; and lastly, the drought was greater at some villages than at others. Notwithstanding all these diversities, it will appear from what we are going to say, that the use of the drill-plough was attended with uncommon success every where.

To shorten, and at the same time give the reader a full view of the purport of this article, I have drawn up a table of the extent of the several pieces of land, the quantity of seed used for sowing them in the old way, the quantity they were sowed with in the new husbandry, and their produce in this last culture. Though these experiments are not related so exactly as my own, I am sure there is no mistake of any consequence in them..

I should have been very glad to have known likewise the exact products of the crops in the old way. I have done all I could to come at the knowledge of them, but have obtained only very few satisfactory accounts. All that I have been able to learn, amounts only to a confirmation of what I found in my accounts of the culture and produce of my own estate; for an exact account thereof has been kept for about forty years past. Beyond that time, my papers furnish me with only the product of now and then a year, but not of any number of years together. These detached hints have however afforded me some curious and useful knowledge. For example, I have learnt by them, that the product of lands was the same in the last age as it is in this. In the year 1668, which is the farthest back that any of my papers take notice of, I find the crops were like those that the same lands have yielded for these last 30 or 40 years.

All my inquiries have shewn me that, in this country, in what are reckoned good years, the lands yield but three times the seed; seldom more, and often less. Some few fields indeed must be excepted, which, being of a very extraordinary goodness, do produce more: and likewise, on the other hand, some very bad lands which do not yield so much: so that, upon the whole, this may be reckoned the medium crop during any number of years.

The neat produce does not by any means amount to the whole of the crop, in the common husbandry: for the good grain is frequently so mixed with bad, and with the seeds of weeds, that it suffers a considerable diminution thereby. The quantity of perfect grain is therefore what ought to be considered; and in this many are apt to deceive themselves. Whenever people become sensible of the small advantage of the common husbandry, they will be more ready to attend to what is said in favour of the new, and will be inclined to verify it by their own experience. When so convinced, they will endeavour to overcome the dislike which most farmers have to this new method. They are, in general, a set of men, fit only to execute what they are bid to do; and therefore ought to be directed by persons of better understanding. Patience and perseverance may by degrees bring them to practise the new husbandry, which time will bring to its greatest perfection.

The following tables will help to strengthen these reflections.

TABLE

TABLE

Of the Extent, Sowing, and Crops of different Pieces of Land in 1754.

Extent.	Quantity of Seed in the old way.	Quantity of feed in the new way.	Crops.
Arpents.	Pounds	Pounds.	Pounds.
$1\frac{1}{2}$	336	168	1560
$1\frac{1}{2}$	356	180	1230
$3\frac{1}{2}$	882	392	2360
1	252	130	650
$3\frac{1}{2}$	882	346	2275
3	672	283	2080
8	2016	670	6110
4	1008	485	4680
$\frac{3}{4}$	190	95	1040
2	504	230	2520
$3\frac{1}{4}$	819	390	3120
$1\frac{1}{4}$	315	140	975
$2\frac{3}{4}$	694	300	2340
Total 36	8926	3809	30940

ARTICLE VII.

General Reflections and Obſervations on the Experiments contained in the foregoing Articles.

AFTER all theſe experiments, I aſk myſelf whether they are ſufficient to give us a ſatisfactory demonſtration that the new huſbandry is more profitable than the old? I anſwer, without heſitation, that it certainly is more profitable, both to the public, and to each individual, whether the lands be cultivated in beds, or whether they are only ſowed in equally diſtant rows, with the drill-plough.

Such will likewiſe be the anſwer to this queſtion, if the reſult of theſe different experiments be conſidered. In the firſt place, we have thoſe of each field in particular; in the next, we have thoſe of ſome whole farms; and laſtly, we have thoſe contained in the table of the ſixth article, to which laſt I ſhall now limit my reflections.

We may look upon the produce of 36 arpents ſpread up and down an extent of nine or ten ſquare leagues, amounting all together to 30940 pounds of wheat, as the medium produce of the generality of lands. I ſhall therefore not dwell upon the produce of each of theſe fields taken ſeparately, but only conſider now, that *36 arpents yielded 30940 pounds of wheat.*

If theſe 36 arpents had been cultivated in the old way, they certainly would not have produced ſo much, ſince we have ſeen that the medium produce is but three times the ſeed; and I am ſatisfied it would have been leſs this year 1754. However, I will ſuppoſe the crop to have yielded three times the quantity of the ſeed. Theſe 36 arpents ſowed with 8926 pounds of wheat, would then have produced 26778 pounds; deducting from which 8926 pounds for the ſeed, *the neat produce will be reduced to 17852 pounds.*

The 36 arpents ſowed with the drill-plough yielded 30940 pounds, from which we are to deduct 3839 pounds, which was all the ſeed that was ſowed. *The neat produce will then be reduced to 27131 pounds, which is 9279 pounds more than would have been produced in the old way.*

The owners or farmers of theſe 36 arpents had therefore 9279 pounds of corn more. They reaped the firſt benefit of this gain, and the public the next, as ſo much more corn was carried to market, than would otherwiſe have been. Such an advantage is very conſiderable, and deſerves the utmoſt attention of the public, whom we invite to conſider it in a more extenſive light. The object will thereby become the more intereſting.

Let us but conſider how much greater a quantity of corn this ſpace of nine or ten ſquare leagues would have produced, if all the arable lands in it had been ſowed with the drill-plough: how much more grain would it not have afforded for the nouriſhment of the people! what increaſe of income to every individual concerned therein! and how ſure a way to guard againſt future dearths!

But this is not yet all. Much greater advantages will ſtill reſult from the cultivating of lands entirely in the new way: I mean, by laying them out in beds, and obſerving all the practices of the new huſbandry. This I proved plainly in my journal of 1753, by the calculations of the articles II. V. and VI. This demonſtration is fully confirmed by the experiments of 1754, the products of which were

were greater, and their refults ftill more favourable to the new method.

What has been already faid on this important fubject, fhews, what the neceffary operations are, how eafily they may be performed, and what are the points which merit moft attention. The theory of the new hufbandry is now fully proved by experiments; and that great principle, the neceffity of preparing the earth well by proper ftirrings, fo clearly demonftrated, that it would be needlefs to infift any longer on it.

But the fowing of the land, which is of the utmoft importance to the fuccefs of the crops, depends greatly on the time and feafon when it is performed, and the care with which it is done. We fhall therefore give fome obfervations on that head.

The three moft effential things which conftitute a good fowing, feem to me to be, next to the proper preparation of the earth, firft, the time of fowing; fecondly, the choice of the feed; and thirdly, the due temperature of the feafon, with refpect to heat or cold, drought, or wet; all which greatly influence the ftate of the earth.

With regard to the time of fowing, I fay, it is better to fow early, than too late, provided the feafon will admit of it. The plants are better able to refift the feverity of the winter, after they have acquired a certain degree of ftrength. There have been years in which fields fowed very late, for inftance in December, have done extremely well: but that ought not to be made a general rule; experience fhewing that fuch late fowings very feldom anfwer.

By too early fowing, the corn is equally expofed to other dangers. The ftalks which fhoot up before winter, cannot well bear hard frofts; which would do no hurt to the wheat when but in blades. I obferved, in the two laft years 1753 and 1754, that the firft fown wheat, which was attacked by the *ruft* in autumn, was much more hurt by it than any other. Therefore, I think the beft time for fowing, in fuch a climate as Geneva, is, from the 20th of Auguft, to the end of September. If, however, it fhould not be practicable to fow all the lands within that time, the firft fortnight in October may likewife be taken in: but this I would not advife, except in a cafe of neceffity. If all the land fhould not be fown within that time, I think one might expect a better crop by deferring to fow till fpring. What I have been faying is more particularly applicable to lands laid out in beds.

The fame rules by which I judge of the proper time of fowing here,

here, may eafily be adapted to other climates, in fome of which the land will require being fowed earlier, and in others later.

The choice of the feed is the fecond thing, which to me feems to require more particular care than many may perhaps imagine. Every one certainly endeavours to chufe the beft wheat he can for feed: and it ought likewife to be very clean. Such corn is not difficult to be had, when reaped off the beds cultivated in our way.

Tho' wheat fo green that it had fcarce loft its milky quality, fprouted pretty well when I tried the experiment with it; I think it is more proper to fow none but what is thoroughly ripe. The feed has then attained its full perfection; and it is from that ripenefs that we may moft certainly expect the moft vigorous plants.

The wheat that has been reaped in a warm dry year, feems to me fitter for fowing, than that which has been gathered in a cold wet year: for in fuch a year, all the productions of the earth are lefs good; their tafte is lefs favoury; and as that wheat in particular in which there is moft moifture, is moft difficult to keep, I infer from thence that the formation of its grain muft be lefs perfect. I fhould therefore prefer wheat a year old, provided the year it was gathered in was warm and dry, to that which may have juft been gathered in too rainy a feafon. Accordingly, I always chufe for fowing, wheat of the growth of my high lands, rather than that which has been produced in flats.

The benefit accruing from all this care, may, perhaps, not be extremely great; but at the fame time it cofts nothing. Let us do in agriculture what is done in all manufactures: the very fmalleft profits, the very leaft favings, are never neglected. Thofe fmall articles, often repeated, make large fums in the long run, and are a real profit.

There is another thing of greater confequence, which I ftrongly recommend the practice of. It will not be attended with any expence. It is by repeated experiments, always attended with the fame fuccefs, that I have found it to be extremely ferviceable to the firft fprouting of the feed. Chance firft made it known to me.

I have often fowed, purely to try what wheat was fitteft for fowing. I commonly fowed wheat taken from the heap in the granary. I likewife frequently fowed wheat picked out of the ears the moment before I fowed it. I counted the grains of both forts exactly. Would any one think there could be any difference in the productions of thefe grains? yet I found a confiderable one: what was picked out of of the ears, always rose extremely well; scarce a grain of it ever missed; whereas numbers of those which were taken from the heap, never sprouted at all. I did not perceive this difference at first; but at last it struck me. I relate the fact as it is, without pretending to account for the cause of this difference, which would lead me into too long a digression. The experiment itself may be of real use. It shews us that instead of threshing the wheat intended for seed at any time, without distinction, it ought not to be threshed till a very few days, at most two or three, before it is sowed. A few hands will be able to supply the sowers with as much as they will want. This will be attended with no sort of expence, and may be the means of saving somewhat in the seed.

Perhaps too, this practice may be attended with a very valuable advantage. I have not indeed yet made the trials necessary to satisfy me of the reality of what I imagine: but my desire to be of service to the public, induces me to mention it, that the lovers of agriculture may reflect upon it, and try such experiments as will clear up my conjectures.

Threshing the seed only just before it is sowed, may possibly, in some measure, or perhaps entirely prevent the first cause of the distemper which we call *charbon*. By this I mean, that the seed which has not been mixed with smutty wheat, or any infected by its black powder, will be exempt from that distemper. Not that I take that black powder to be absolutely the original cause of that distemper: but I believe it very capable of communicating it to grains that are sound.

I wish the multiplicity of my occupations may permit me to endeavour to clear up this matter, and pursue the observations I have begun to make. If I can be so happy as to make any useful discoveries, I shall communicate them to the public.

That nothing may be neglected which can be of any service to the seed, great care ought, in my opinion, to be taken in threshing it; especially in the manner that is commonly practised, with flails, upon the barn floor, or by trampling it with horses. In either of these ways, a great number of grains are so bruised and hurt, that it is impossible they should ever grow. If the wheat intended for seed, is not thoroughly dry and hard, the mischief is still greater; much more of it being then absolutely crushed by the flail.

As the new husbandry requires much less seed, it will be the easier

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to execute an operation which might be too long and troublesome to practise for so great a quantity as is used in the old way.

The method I advise, and which I myself have practised, is this: let one or two beams, two feet and a half, or three feet thick, be laid across the barn floor: let the threshers stand at each side of the beam, with a loose sheaf of wheat behind every man, from which he will take a handful at a time, and give it two or three strokes against the beam: this will bring out a great deal of grain, which is to be reserved for seed. These ears may be bundled up again, and afterwards threshed out with the flail, for other uses.

This method is not so tedious as some may imagine: we are sure that not a grain is bruised; the corns drop very readily out of the ears, especially of wheat that has grown in beds: the great size of the grain helps to open the husks, and those are the most perfect grains which drop out thus. I think I may compare this operation with what is done in the making of wine. The first running is always the highest flavour'd and best.

Though the proper season for sowing be come, the corn ought not to be put into the earth, if the temperature of the season is not favourable. It ought on the contrary, to be deferred in hopes of a change. If the weather is very hot, and the earth extremely dry, there will be an absolute necessity of waiting till some rain has fallen. Without this precaution, the seed will rise but very imperfectly. I am sure of it, by several experiments which I have made, and which contradict a common saying of our farmers, that the earth is the best granary to keep corn. Full of this notion, whenever the stated time comes round, they sow, without distinction, in wet or dry land: even heat does not hinder them: they think their seed will certainly sprout well after the first rain: but I have always experienced that the plants have come up thin.

I tried an experiment purposely to satisfy myself whether one can sow with success, when the weather is very hot, and the earth very dry. Upon reading Mr. Duhamel du Monceau's excellent treatise of the preservation of corn, I observed that he had found by his experiments, that wheat which had been dried in a stove heated to 60 degrees of M. de Reaumur's thermometer, had lost its faculty of growing.

From thence I conjectured that wheat which should undergo a heat, for example, of 30 degrees, during a longer time, would be equally

equally parched up, and rendered incapable of growing. I confidered the earth, when hot and dry, as a kind of ftove, in which if the feed remained too long, without receiving any moifture, it may become fo dry, that the greateft part of it will never be able to fprout. I thought this reafoning juft; and therefore determined, in order fully to fatisfy myfelf, to have recourfe to that trufty guide, experience.

The 18th of July, 1754, at four o'clock in the afternoon, I placed M. de Reaumur's thermometer two inches deep in the earth, and fcreened it from the immediate impreffion of the rays of the fun. The liquor rofe to the 31ft degree, which fhewed me the heat of the earth.

The thermometer being afterwards expofed to the fun, the liquor rofe to 56 degrees.

The fame day, I fowed 80 grains of wheat in the fame ground. The heat continued nearly the fame the reft of that month, and almoft all Auguft. On the 31ft of July, only 10 grains had fhot up, and the 16th of Auguft there were in all 16; after which, not one more rofe: confequently 64 grains out of the 80 never fprouted at all *.

The 28th of July I fowed 50 grains. Only four of them rofe by the 16th of Auguft, and not one after. Here were again 46 grains which did not grow at all.

The fame day, I fowed 60 grains in another place. The 16th of Auguft only fix grains had fprouted, and not one plant more ever appeared after: confequently here too were 54 grains which never grew. All thefe grains were fowed in my garden, in exceeding good mould.

I was fure that the wheat I fowed was perfectly found, and in every refpect capable of growing. It was therefore quite clear, that fo great a number of grains out of the whole, which did not fprout at all, had loft the faculty of growing, by their being parched up by the heat and drynefs of the earth. To be ftill more certain of this, three weeks after I had fowed thefe grains, I watered half of them feveral times; but to no purpofe: not one of them rofe, and I found feveral of them quite whole in the earth where I had fowed them.

After this experiment, on the 11th of Auguft I fufpended the fowings I had begun the 8th, and did not refume them till the 26th, after fome rain which fell the 22d and 23d. Thefe laft fowings rofe much better than the firft.

* Wheat has however been known to rife very well after having remained fix weeks or two months in the earth: perhaps the circumftances were different.

Thus it is that experience and obſervation teach us to leave off bad cuſtoms, or ſuch as are not founded on principles with which a man of ſenſe can reſt ſatisfied.

Whenever the produce of the fields on which my experiments were tried, is conſidered, it ought always to be remembered, that I uſed no dung on any of thoſe lands, and that they received no other improvement than what was owing to a better preparation of the earth, only by ſtirring it. Thoſe who chuſe to have recourſe to dung, will probably reap greater crops: with an hundred loads, they may dung three times more land than is done in the common way; for the dung ſhould be ſpread very thin, if one would have it be of any ſervice. By ſpreading it too thick, I believe the plants would grow too rank, and be apt to be lodged.

The new huſbandry ſupplies the want of dung, not only by ſtirring the earth, and not over-burdening it with too many plants, *but likewiſe by the ſtrong thick ſtubble it produces, which affords a moſt excellent manure, attended with no expence.* It lies ready upon the ſpot; the plowing of the earth buries it; and as it is a long time in rotting, it helps to keep the ſoil looſe and light, and is repeated every year. I have found ſtubble almoſt whole at a year's end; and ſome I have ſeen not quite conſumed at the end of two years.

But can we be ſure that this manure is of any conſequence, or real advantage? After what I have already ſeen of its effects, I will venture to ſay, that it contributes greatly to increaſe the productions of the earth. I have very often plucked up plants remarkable for their beauty, and have frequently found their roots interwoven with tufts of ſtubble, which ſhewed me the cauſe of their extraordinary growth. I ſhall ſoon have more poſitive proofs of this, by the experiments I am now making to clear up this point.

ARTICLE VIII.

Experiments made on beds ſowed with ſix rows of wheat: compariſon of their produce, with that of beds ſowed with only three rows; and ſome inquiry concerning the number of rows which it is beſt to ſow.

IN the journal of 1753, article VII. I gave an account of my ſucceſs in ſowing beds with two turns of the drill-plough, in order to have ſix rows of wheat. It anſwered ſo well, that I thought I ſhould run no hazard in ſowing a larger extent of ground in the ſame manner,

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This experiment ſucceeded equally well this year. I ſhall not enter into a detail of it, becauſe that would be only a repetition of what I ſaid on this ſubject in 1753. As to the reſult, the reader will recollect, that the ſame ground made into beds wide enough to be ſowed with two turns of the drill-plough, which make ſix rows, produced more corn than if it had been ſown in beds with only one draught of the drill-plough, which would have made but three rows.

With regard to the quantity of the products of the crops of 1753 and 1754, compared together, I have found that the ſix rowed beds produced this year very nearly the ſame that they did in 1753; excepting the field of the experiment, No. VIII. which yielded about half as much again as the year before.

Notwithſtanding the profit which I found in theſe experiments repeated two years running, I do not think it adviſeable to enlarge the number of rows to ſo many as ſix. Five will, in my opinion, be very ſufficient: and they may be made with one cut of the drill-plough, by giving it five ſhares, which is very eaſily done. This number of rows will be a proper medium between ſix and three.

Sowing in five rows will not, however, do in all ſorts of lands. I believe it ſhould be practiſed on none but good ones, and that middling lands ſhould continue to be ſowed with three rows at moſt.

I ſhall add farther, with reſpect to good lands, that they ought not to be ſowed with five rows, till after they have been thoroughly well ſtirred; and, above all, not till after the great furrow in the middle of the bed has been cut extremely deep, in order that the roots of the middle row, which is the moſt diſtant from the plowed alleys, may find a ſufficient depth of mould immediately under them, to ſupply them with their neceſſary nouriſhment.

But at the ſame time that a proviſion is made for the nouriſhment of the plants, care muſt be taken not to looſe too much land, by making the alleys wider than they need be. My experiments have determined me to make my beds for the future about ſix feet wide. By leaving ſeven inches diſtance between each row, the five rows will take up about two feet four inches, and there will remain three feet eight inches for the breadth of the alleys. This ſpace is ſufficient for the plough or cultivator to operate in with eaſe.

ARTICLE IX.

Experiment made in order to know which is the moſt profitable way of ſowing the beds, and to aſcertain more preciſely the quantity of ſeed proper to be uſed, in order to have the greateſt crop.

THE title of this article divides it naturally into two parts, which I ſhall treat ſeparately.

It is of great conſequence to know which is the moſt profitable way of ſowing the beds; that is to ſay, that by which they will be ſtocked with a proper number of plants; for when too much ſeed is ſowed, the plants hurt one another; and when too little, the earth is not enabled to produce ſo much as it is capable of doing.

The buſineſs therefore is, to determine what number of plants would be moſt advantageous. Luckily, the difference is wide enough between the too great, and the too ſmall number; and the produce of the crops cannot be diminiſhed but by an exceſs one way or the other.

But whatever certainty we may acquire with reſpect to this intereſting point, we cannot flatter ourſelves that we ſhall always be able to keep to it in our practice. The various accidents to which corn is liable, from the hour of its being ſowed till it is reaped, will always fruſtrate the methodical arrangement which we may have intended to give the plants.

The difficulty of ſucceeding in this inquiry, ought not however to diſcourage us: for it would be attended with ſuch advantages as would make very ample amends for all the labours beſtowed upon it. Let us then have recourſe to experiments. Thoſe that are made with this view, will never be quite uſeleſs. If they do not lead us to the very thing we are in ſearch of, they may at leaſt diſcover to us others which may be of ſervice.

According to our principles, the diſtance between each plant ought to be equal throughout the whole length of the rows, that all of them may have an equal quantity of earth to draw their nouriſhment from.

Several experiments have ſhewn that ſix inches is not too great a diſtance for the plants to be at from one another. In this caſe, it would be ſufficient to ſow one grain of wheat from ſix to ſix inches. According to this diſpoſition, a field well prepared ought to produce the greateſt crop. The plants will very commonly branch out ſo as to have 20, 30, or 40 ſtalks: I have had ſome with upwards of 80. 'Tis pity that this exact diſtribution of the ſeed cannot ſubſiſt long. The accidents I met with, ſoon convinced me, that it was neceſſary to increaſe the quantity of the ſeed, and that very conſiderably.

However, this does not yet hinder me from thinking, that if any eaſy method could be found, to have a plant of wheat exactly at every ſix inches diſtance in the rows, it would be the beſt way of ſowing lands. I have often conſidered how this could be reduced to practice, as well to ſatisfy my curioſity, as that I might be the better able to proceed in my operations. When a theory is known to be good, one is ſtrongly encouraged to draw all poſſible advantages from it for the practical part; one proceeds with confidence and pleaſure.

Experience having convinced me that it never would be poſſible to have a plant at every ſix inches in each row, by ſowing only a ſingle grain of wheat at thoſe diſtances; it naturally followed, that the way to have the ground better covered with plants was, to ſow more grains. The next queſtion was, how many grains ſhould be ſowed in each place: ſhould it be two, three, or more? Experience only could clear this doubt. I therefore tried the following experiment. I ſowed a different number of grains *in cluſters, ſix inches diſtant from each other*; putting one grain in the firſt, two in the ſecond, and ſo on to the ſixth, which had ſix grains: then I began again, and went on as before, till the whole length of the row was ſowed in this manner. The produce of each cluſter was to ſhew me whether it would be beſt to double, triple, or quadruple the ſeed, which it was plain had been ſowed too thin, when only a ſingle grain was dropt at every ſix inches.

The winter of 1753 was already far advanced when theſe thoughts firſt occurred to me. It was then too late to try this experiment with wheat: but, that I might not loſe a year, I did it in the ſpring with barley; not doubting but that corn, which is uſually ſowed in March, might furniſh me with ſome uſeful hints for the culture of that which remains longer in the ground.

Accordingly, the ninth of April 1754, I ordered another bed to be ſowed with barley, in my preſence, and in the manner I have juſt related. I counted all the grains of each cluſter myſelf. They were ſowed in three rows. I varied the experiment in the row next the ſouth, by ſowing no cluſters there of leſs than 3, 4, 5, or 6 grains; which I continued the whole length of the row. At harveſt, all the cluſters in which ſeveral grains had been ſowed, were ſo thick, that they touched one another.

What is of moſt conſequence to our culture, is, to know the produce of each cluſter. The annexed table ſhews it particularly. I ſhall only add, that the cluſters, as they are here ranged under their reſpective numbers, occupied forty feet in length.

EXPLANATION

Of the table of the bed ſowed in cluſters with barley, and its product.

FIGURE I.

The ſouth row has 24 numbers.

FIGURE II.

The middle row has 16 numbers.

FIGURE III.

The north row has 16 numbers.

Theſe numbers are ſubdivided into ſmall ſquares, in the upper ones of which are the number of grains ſowed in each cluſter.

The lower ones contain the number of ſtalks bearing ears, which each cluſter produced.

Each number contains an equal number of ſmall ſquares, and under each number of each of theſe ſquares, is ſet down the number of grains that were ſowed: thoſe of 4 cluſters have 18 grains; thoſe of ſix, 21.

The cyphers in ſome of the lower ſquares of fig. II. and III. are the places where no plant grew.

RESULTS.

The SOUTH ROW,

ſowed with 6, 5, 4, and 3 grains,
produced 661, 624, 447, and 493 ſtalks.
In all 2225 ſtalks.

The MIDDLE ROW,

ſowed with 1, 2, 3, 4, 5, and 6 grains,
produced 48, 72, 147, 204, 219, and 487 ſtalks,
In all 1177 ſtalks.

The

INSERT FOLDOUT HERE

[illegible]

[illegible] 200 [illegible]

[illegible] figures, [illegible] quantity [illegible]

On the fixing of [illegible] figures [illegible] breadth of the [illegible] would [illegible] ground [illegible] is [illegible]

[illegible]

The [illegible]

[illegible]

The NORTH ROW,

sowed with	6,	5,	4,	3,	2, and	1 grains,	
produced	502,	372,	345,	276,	200, and	92 stalks.	

In all 1787 stalks.

Consequently the whole number of stalks in the three rows was 5189. They yielded 17 pounds of grain, besides a great quantity that was shed in reaping.

On the footing of this crop, an arpent of 37 square toises would contain at least 44 beds five feet wide, which was the breadth of the bed on which this experiment was made. The beds would be 222 feet long: the produce of one of them would be 93 pounds 8 ounces, and that of the 44, 4138 pounds 8 ounces, that is to say, near 200 bushels to the whole arpent: a very considerable crop, and which might be carried still much farther by other experiments of this kind, as we shall soon see.

REMARKS.

THE following observations deserve the reader's utmost attention. First, By this experiment, I have very near effected what I aimed at, *viz.* to have two or more plants grow so close together as to seem but one; and that at six inches distance from each other. If the three rows had been joined together lengthways, they would have been 120 feet long, and ought to have contained but 240 plants: but the distances, which were marked by guess, not being exactly six inches each, 96 clusters were sowed in each row, which made 16 clusters over and above. By this means, several of them were nearer than six inches to one another.

Two hundred and eighty-eight clusters were sown, all of which produced plants, except 25 which did not sprout, or of which the plants perished. This deficiency is not very considerable: but we must observe, 1. That almost all the places where this happened had been sown with only one or two grains of wheat: 2. That it was in the middle row that the greatest number of plants was wanting: 3. That the south row, in which the smallest quantity sown for any one tuft was three grains, furnished and retained its full number of plants: and lastly, that almost all those which were

next

next to the vacant ſpaces, were ſtronger than the reſt, and thereby made amends for the loſs of the others.

Secondly, The whole number of the ſtalks amounted to 5189, which is after the rate of 43 ſtalks and a quarter to a foot: but it is much more conſiderable in the ſouth row, which having produced in all 2225 ſtalks, the proportion is 55 and a half to a foot. The cauſe of this difference is eaſily ſeen. The expoſition of that row, to the ſouth, being more favourable than that of the others, may have contributed thereto; but it is very plain that it was chiefly owing to none of the cluſters in that row being ſown with ſo few as one or two grains.

Thirdly, We ſee that the increaſe of the ſtalks was, in general, in proportion to that of the ſeed; only the cluſters that were ſown with three grains in the ſouth row, produced 46 ſtalks more than thoſe which were ſown with 4 grains; but ſtill the general reſult of the three rows remains exactly in the ſame progreſſion, as appears by the following recapitulation.

RECAPITULATION:

Stalks produced by	*1 grain.*	140
	2 gr.	272
	3 gr.	916
	4 gr.	996
	5 gr.	1215
	6 gr.	1650
	Total	5189

Fourthly, The ears were nearly equal, at leaſt in two-thirds of the length of the rows: the other third ſurpaſſed the reſt, as will appear by the following extract of the twelve firſt numbers of the South row.

No. 1	*produced*	87	*ſtalks.*
2		122	
3		91	
4		99	
5		82	
6		66	

No.

No. 7	. *produced* .	78	*ſtalks.*
8	. . . .	100	
9	. . . .	87	
10	. . . .	116	
11	. . . .	148	
12	. . . .	68	

Fifthly, The difference between the produce of the cluſters ſowed with one and with ſix grains, is extremely great. The former produced but 140 ſtalks; the others multiplied to 1650. 'Tis true the number of the cluſters of ſix grains is greateſt; which is ſome ſmall diminution of the difference.

Sixthly, I obſerved ſeveral ſtalks from which others had ſhot out, all as ſtrong, and as long, as thoſe from which they derived their origin. They proceeded from the firſt joint above the ſurface of the earth, generally at the heighth of three, four, or five inches, and were two, three, and ſometimes four in number. I never perceived this kind of multiplication before; but had, till then, always obſerved it to be at the neck, or point of ſeparation between the roots which deſcend, and the ſtalks which aſcend, that the plants branched out.

Seventhly, I ſuſpected, in the ſummer, what was the cauſe of the great vigour of the plants of this experiment; but I ſaw it much plainer after harveſt: for, upon pulling up ſome of the tufts of ſtubble, I found their roots innumerable. This fact is ſtrictly true. I could not count them upon any one plant that had more than 15 or 20 ſtalks. Theſe roots were in ſuch bundles, and ſo confuſedly interwoven one with another, that after counting ſeveral hundreds of them, I was forced to give up the taſk. Their length and thickneſs was anſwerable to their number.

I muſt now remind the reader of what I ſaid before, that the ſeveral accidents which I met with in my firſt experiments, ſhewed me it was neceſſary to increaſe the quantity of the ſeed. I did ſo, by ſmall degrees, from year to year. It is equally important for the ſucceſs of the new culture, not to run into another extreme by loading the earth with more plants than it can nouriſh: the crop would be conſiderably diminiſhed thereby.

It appears by this experiment, that the cluſters which were ſowed with ſix grains, did not hurt one another: on the contrary, their being ſown in that manner proved an advantage, ſince they produced much

much more than the others: whence it follows, that one may, without danger, extend the quantity of the ſeed beyond the limits of the principles of the new huſbandry. Its principles are not the leſs true: but they leave the farmer at liberty to uſe his own prudence in the application of them, according to the nature of the ſoil.

Thoſe principles, which ſuppoſe that every plant is to ſubſiſt till harveſt, reduce the ſeed to a very ſmall quantity: but numbers of accidents deſtroy many of them. Our reaſon ought conſequently to tell us, that, without deviating too much from the principles we adopt, we may, and ſhould judiciouſly ſtock our land with a ſufficient number of plants, in order to guard againſt unavoidable accidents.

Still I may be aſked, what is that ſufficient quantity? I anſwer, that our experiment ſhews that ſowing ſix grains together in a cluſter, from ſix to ſix inches, all the length of the rows, will not be found too thick. By following this rule, one may be almoſt certain that the whole ground will be ſtocked with a proper number of plants. This ought, however, to be looked upon only as a general propoſition, which it will often be very proper to deviate from in the circumſtances we are going to mention:

When the ſowing ſeaſon is favourable.
When the land is well prepared.
In countries where the winter is ſeldom ſevere.
When the land is but little liable to inſects.
When the land is not in danger of being hurt by too much drought, or too much wet. And laſtly,
When the land is good and very fertile:

In all theſe, and other ſuch like caſes, leſs ſeed ſhould be ſowed; and, in the contrary caſes, more. Prudence, and a careful ſtudy of the nature of the ſoil, ought to be our guides. Two or three years experience will be ſufficient to ſhew us the practice that will be beſt to follow.

It will be right to repeat our laſt mentioned experiment, and even to vary it. In all probability it will afford us ſtill greater lights. It will be right, for example, to ſow the cluſters with a greater number of grains, beginning with ſix, the produce of which is known, and

and going on to ſeven, eight, and even more, always in cluſters, till one comes to a number at which the crop ceaſes to yield an equal profit. By this means, the two extremes may be known, either of too much, or too little ſeed; and the juſt proportion will then be eaſily determined.

Some farther alterations may likewiſe be made in this experiment. For example, I placed the grains in the earth ſo that they touched one another. I will try to put them at ſome little diſtance from each other, and to arrange them in a kind of circle, of about three inches diameter. It is reaſonable to think, that the plants may make a greater progreſs then, as they will not all have one common center: ſome of them will be nearer to the plowed alley; their roots will reach it more eaſily than before, and will multiply there, which may render the plants more vigorous.

ARTICLE X.

General diſpoſition for the farther progreſs of the new Huſbandry, and particularly for the crop of 1755.

IT is with uncommon ſatisfaction that we ſee the trials of the new huſbandry multiply daily. A great number of intelligent perſons have ſown part of their lands in equally diſtant rows, with the drill-plough, for the next harveſt. We have already ſeveral farms, ſome of which are conſiderable ones, in the neighbourhood of Geneva which are no longer ſown any other way.

'Tis a great deal to ſee this new road thus readily entered into. Thoſe who follow will ſoon begin to take a pleaſure in calculating, and will be curious to compare the new crops with the old. Theſe calculations will inſenſibly lead to others, on the produce of land, when laid out in beds. They will ſee, that there can be no hazard in making a few trials. Thus it is that ſeveral have been determined to cultivate ſome of their lands this year in beds.

That theſe arguments ſhould have their full weight with men capable of reaſoning, is not to be wondered at: but I confeſs I have been agreeably ſurpriſed, to find this conviction extend to people who can ſeldom be prevailed on to leave their beaten track. Some peaſants in theſe parts ſent a meſſenger this winter to tell me, that they began to have a good opinion of the method I practiſed; that they were aſtoniſhed at the beauty of my young plants, the like to which they had never ſeen before; and that if they continued to do well, and met with no accident, I ought to have a prodigious crop. After this preamble, he continued, ſaying, that he was directed to beg of me to give him the particulars of my experiments; that they ſhould meet, ſeveral of them together, to read them over in the winter, and make their little reflections upon them. He concluded with adding: "I believe we ſhall all agree to ſow in equally diſtant rows, "with the drill-plough; and perhaps too we may, by and bye, lay "our lands out in beds."

I own I found a great deal of good ſenſe and prudence in this conduct of the peaſants. I gave them the experiments of 1753, and ſent them word that both my advice and my drill-plough were at their ſervice, and that it ſhould coſt them nothing if they choſe to make a trial of it. They have been well ſatisfied with what they have read, and ſeem diſpoſed to accept of my offers.

I have experienced this year, more than ever, the facility with which lands are cultivated in the new way. No part of the farm where I ſometimes make a little ſtay, is any longer cultivated after the old method. The moſt troubleſome part is now over: my lands were ſowed in a favourable ſeaſon; the plants roſe extremely well, and flouriſhed perfectly till the beginning of winter: but the ſeverity of the froſts has proved fatal to many parts of my fields, and will certainly be a detriment to my crops.

SECT. V.

Continuation of M. DE CHATEAU-VIEUX's *Experiments in* 1755 *and* 1756.

MY lands were cultivated in 1755, in the ſame manner as they were the years before. I ſhall therefore not enter into any detail upon that ſubject. When I ſowed my fields, they were very well prepared to receive the ſeed; the ſpring was pretty kindly; and towards the end of autumn my corn was very fine, excepting ſome ſpots that were attacked with the *ruſt* ſo early as the tenth of November: other places in which the plants were ſtrong and healthy, promiſed a moſt plentiful crop; and though it was greatly diminiſhed by the winter's froſts, it proved, upon the whole, ſufficient to confirm the advantages of the new huſbandry, which have been already proved in my former accounts.

The winter of the year 1754, was a moſt ſevere one. The froſt, which was exceſſively intenſe, laſted a long time, and killed a prodigious

digious number of plants: thoſe that reſiſted it, loſt ſome of the branches they had ſhot out in the autumn before, and the plants ſo weakened branched but little in the ſpring. The evil would have been infinitely greater, if the ground had chanced to be full of water, when thoſe extreme hard froſts came on: but luckily it was not very wet.

This winter was followed by a very dry ſpring, uncommonly hot, and conſequently unfit to recover the corn. The ſummer, in which there was ſcarce any rain or dew, but very frequently ſultry ſcorching heats, exhauſted the plants in ſeveral fields. I was not ſurpriſed at it. The ſeaſons were extremely unfavourable to the productions of the earth; and, to add to the misfortune, a vaſt quantity of worms did likewiſe conſiderable damage to the corn.

However, my wheat roſe; the ſtraw was pretty near as long as in the preceding years, and the ears were well filled with grain. The plowings had been well performed, which kept the earth in a ſtate of moiſture; leſs indeed than in 1754, becauſe but very little dew fell in 1755.

The wheat cultivated in the old way, yielded but few ſheaves: the ſtraw was ſhort; the ears were very full of grain; and, in general, the quality of the corn was excellent.

There was room to expect good ſucceſs from the lands that were ſown in 1755, for the crop of 1756. The young plants roſe extremely well, the ground had been properly prepared, and had the degree of moiſture neceſſary to promote their growth.

Though ſome ſlight froſts were felt towards the latter end of October, they did not prevent the growth of the corn, the cold abating from the twelfth of November, to the end of that month. M. de Reaumur's thermometer was, during that time, at from ſix to eight degrees above the freezing point. At the ſame time we had pretty frequent, and often plentiful ſhowers of rain.

The corn was in very good condition at the beginning of the winter, during which there was ſcarce any froſt, excepting the ten firſt days of December, when the thermometer fell to about ſix degrees below the freezing point. During the months of January and February, it was pretty conſtantly above the freezing point: we had little ſnow; but pretty frequent rains.

The ſpring and ſummer of 1756, having been extremely rainy, and the earth too much ſoaked thereby, the plants were poor, and the ſummer plowings could not be given them. For this reaſon, I could give ſeveral of my fields but one culture; and others had two. I would not plow whilſt the earth was ſo very wet: it would only have hardened, and as it were kneaded it; and I judged that ſuch bad plowings would have been equally prejudicial to the corn then growing, and to the preparation of the fallow for the next ſowing. I found afterwards that I had done right.

One could not but expect that ſo unfavourable a ſeaſon would prove fatal to the corn. I had obſerved during all the month of April, in which there was no froſt, and the thermometer was from five to ſeven degrees above the freezing point, and towards the end of that month from nine to twelve degrees, that the corn made but little progreſs, and grew yellow. The diſtemper continuing to increaſe, I perceived in May, that the corn was attacked with what is called *the rickets*: the bad ſtate of the roots of theſe plants, the colour of their blades turned to a blueiſh green, and yellow at the point, left no room to doubt what ailed them; and from that time it was eaſy to foreſee, that beſides the ſmallneſs of the number of ſtalks which the plants had produced, and by which the crop would certainly be ſcanty, it would be diminiſhed ſtill more, by the ears having but little grain.

In June, the healthy plants throve greatly: the ſtraw grew long: but yet the ſheaves did not yield ſo much grain as in the foregoing years, by about a fifth part, as nearly as I could judge. The corn was very fine and very clean; and had it not been for this accident, I am confident I ſhould have had a very plentiful crop.

I did not ſee any one field exempt from this diſtemper. Exceeding fine corn, cultivated in the old way, was totally infected with it; and the ſheaves in general yielded but about half the quantity of corn that they uſually do in good years. The grains were very ſmall, and mixed with a great many ſeeds of weeds.

Theſe general notions are neceſſary, in order to form a right judgment of the reſult of my experiments, which I ſhall relate in the following order.

The firſt article will comprehend the experiment which I made upon all the fields which I laid out in beds, the laſt of which now bore their third crop. I have diſtinguiſhed them by the ſame numbers as in the former years, and ſhall add to each the particular obſervations that relate immediately to it.

The ſecond article will ſhew the produce of the lands ſowed in equally diſtant rows, with the drill-plough. I ſhall make ſome re-

flections

flections on the uſefulneſs of this practice, which is certainly always preferable to the common way of ſowing.

I ſhall prove in the third article, that it is ſtill more profitable to lay the ground out in beds. This proof will reſult from the calculations and compariſons of the produce in each different way.

ARTICLE I.

Experiments made on fields laid out in beds, the laſt made of which have borne three ſucceeding crops. Theſe fields are diſtinguiſhed by the ſame numbers as in the foregoing years. Obſervations relating particularly to each experiment.

EXPERIMENT, No. I.

YEAR 1755.

N. B. *This was made on the ſame piece of ground on which I made my firſt experiments in 1751: and this year's crop was the ſixth, without any interruption.*

I Gave a very full account, in the ninth article of the year 1754, of the experiment which I made in order to be the better able to judge which is the moſt profitable way of ſowing the beds; and to determine what quantity of ſeed it is moſt proper to ſow, in order to have the greateſt crop; and this I called, *ſowing in cluſters, at the diſtance of ſix inches from the center of the one to the other.* I ſhall only remind the reader here, that the ſpot of ground which was ſowed in cluſters, with barley, in the ſpring, was part of a bed, forty feet long, and that the produce of the grain was ſeventeen pounds weight, beſides a conſiderable quantity that was ſhed in reaping.

This experiment, which deſerved to be repeated, was tried again the ſame year, and upon the ſame ground which I had ſowed with barley. This laſt grain being reaped, I ſowed the ſame bed with wheat, the twenty-third of September following: but it is to be obſerved that I did not plow this ſpot after the barley was off, but only plucked up the ſtubble, and made three channels, into which the ſeed was dropt by hand in cluſters ſix inches diſtant from one another.

As in the experiment of 1754, the cluſters ſowed with ſix grains, were

were thoſe which produced the moſt ſtalks and grains, I ſowed all the cluſters with at leaſt ſix grains, ſome with ſeven, and others with eight; keeping all the grains at ſome little diſtance from each other. The bed forty feet long contained eighty-three cluſters in each row, which were ſowed with two ounces ſix pennyweights of wheat.

The plants came up very well: I ſpared no pains to cultivate them; they throve wonderfully till harveſt: their blades, ſtalks, ears, and grains, were very fine; and I preſerved them from the birds with a net: but as I would not reap them till they were thoroughly ripe, a great deal was ſhed in cutting them down, and they yielded me but twenty-eight pounds.

OBSERVATIONS.

THIS experiment is a farther confirmation of the reſult of the firſt which was made in 1754, *viz.* that ſix grains are not too great a number to be ſowed in a cluſter, ſix inches diſtant from the next cluſter. I had not leiſure to count the ſtalks which each cluſter produced; but the twenty-eight pounds weight of corn which they yielded, ſeems a ſufficient proof.

The circumſtance of not plowing the bed before it was ſowed, confirms the advantages of preparing land according to the new huſbandry.

I ſaid that the ſtubble was plucked up, in order to prepare the bed for being ſowed. This ſhewed me how much ſtubble helps to enrich land.

When this bed was ſowed, and the corn ſprung up, I ordered the furrows which were made before winter, next the outward rows, to be opened for about half the length of that bed; and the ſtubble to be put into them, and covered over with earth: conſequently it was laid in the ground which was cultivated, and in that part of it where the plants were to extend their roots. As the quantity of roots collected there was pretty great, I concluded that the effect ought to be much more ſenſible than it can be in other fields where the plowman buries them as chance directs. In effect, that part of the bed became much finer than the reſt; the plants produced a greater number of ſtalks; and there is no room to doubt that the ſtubble was an excellent manure.

YEAR

YEAR 1756.

I Purposed to continue sowing this bed in clusters, and to increase the quantity of the seed, in order to see what the effect would be: but, in hopes of better success, I gave up the thoughts I once had of reaping a third crop from this bed without plowing it.

After one plowing, I sowed it, the sixteenth of September 1755, in three rows of 93 clusters in each row, and 10 or 15 grains in each cluster: and in order to place them with some kind of regularity, I made use of an iron hoop about three inches diameter, which was laid upon the ground at each place that was to be sowed, and the grains were dropt at nearly equal distances, some round the inside, and some in the middle of this circle. Each cluster was sowed in this manner. The space from one center to another, was about five inches. The seed was covered over lightly, with a rake, and the quantity employed in this operation, was five ounces twelve pennyweights.

This wheat was always very fine, from its first rising, till harvest. It was reaped the thirty-first of July, and yielded twenty-three pounds of grain.

OBSERVATIONS.

THOUGH the produce of this bed was less this year than in 1755, I did not think it ought to be imputed to the increase of the quantity of seed that was sowed, because the plants were as strong as could be wished, their straw as long as in the former years, and their ears as big: but I observed that this bed had not been quite free from sickness, and that it contained a pretty considerable number of rickety plants, which yielded but little grain.

It results from this experiment, that a certain quantity of seed is necessary, to counterbalance the many accidents to which corn is perpetually liable.

Though this bed might have yielded a greater quantity of grain in a more kindly year; yet its product, even in this, was very considerable: for if we reckon in proportion the produce of an arpent, which I suppose to consist of 100 square perches (the perch of 22 feet) containing 484 square feet, the breadth of which make four beds of five feet and an half wide each, it would yield 3795 pounds of of grain, produced by 56 pounds, 10 ounces of feed: which is after the rate of 67 for 1.

To this it will be objected, that tho' a fmall fpot of ground, like that we have been fpeaking of, was made to produce fo confiderable a quantity of grain, it would probably not be poffible to obtain fuch a crop in proportion from an extent of fome acres of land.—It may be fo: but fuppofing the crop to be even greatly inferior, it would ftill be much more confiderable than the common crops.

Let us examine this queftion more minutely. It is of great confequence not to embrace an opinion, and efpecially a difadvantageous one, before it has been carefully confidered. Let us fee then to what the diminution of the crop may be owing. I fay nothing of the particular accidents which may in general leffen crops: but, fuppofing all things equal, in fuch an extent of ground, my opinion is that the firft and effential caufe of the mifcarriage, can be imputed only to the cultivator himfelf, who fees what is beft to be done, but neglects it; and who ought at leaft to endeavour, as much as poffibly he can, to do that in great, which he fees fucceed fo well in fmall.

I grant that many reflections, and reafonings, which feem at firft fight extremely juft and appofite, are in reality oftentimes only fpecious and deceitful, and that it is always right to recur to experimental proofs. Luckily we have fuch ready to produce.

The celebrated Wolfius obferved long ago, that the productions of plants which grow in large pieces of ground, are always fine when the feed has been properly buried, and fowed thin: whence he concluded, that the moft extenfive fields ought to produce as much in proportion as fmall ones, and that it is evident that whenever an experiment has been made with the neceffary precautions, and has fucceeded upon the tenth part of any piece of ground, it ought to fucceed equally upon two, three, or four tenths, and confequently upon the whole of that ground.

The experience of five years, of which I fhall give an account in the following article, will, I believe, prove this very fufficiently.

EXPERIMENT. No. II.

N. B. *This field is marked with the same number in the former experiments.*

For the crop of 1752, *it was sowed with* 11 *pounds* 4 *ounces of wheat, which produced* 1041 *pounds* 12 *ounces.*

For the crop of 1753, *it was sowed with* 34 *pounds* 14 *ounces, which produced* 1575 *pounds.*

For the crop of 1754, *it was sowed with* 61 *pounds* 14 *ounces, which produced* 1820 *pounds.*

For the crop of 1755, *it was sowed with* 78 *pounds, which produced* 1950 *pounds.*

For the crop of 1756, *it was sowed with* 51 *pounds, which produced* 1885 *pounds.*

YEAR 1755.

I Had now cultivated Smyrna wheat for some years, sowing the whole of each year's produce, in order to increase my quantity so as to be able to sow a pretty large field with it; which I could not compleat till 1754, for the crop of 1755.

The field in question was sowed with 78 pounds of this corn. It rose very well: but towards the end of winter, I was surprised to find that a great quantity of plants had been destroyed by the frost; and I soon perceived, that almost all the strongest and healthiest plants were those of common wheat, and that there were very few of Smyrna wheat. I had observed at the time of sowing, that there was some mixture in the seed: and as I had some of the same sort still remaining, I was able to satisfy myself that there was a third part of common wheat in the Smyrna wheat which I had sowed; and that it was the former which grew so fine, and of which almost the whole crop consisted.

This shews that Smyrna wheat does not resist hard frosts: but at the same time, such winters as that of 1754, very seldom happen in this country. This field was reaped the nineteenth of July. the common wheat was thorough ripe, and the Smyrna wheat quite green, though its grain was grown very hard.

I separated the ears of Smyrna wheat from the others, in order to bind them up in diſtinct ſheaves, that I might have their grain pure and unmixed. This field produced 213 pounds of Smyrna wheat, and 1737 pounds of common wheat; in all 1950 pounds: which is a greater crop than that of the preceding years.

OBSERVATIONS on Smyrna wheat.

MY former crops of this wheat, though the quantity was but ſmall, had already ſhewed me plainly that it produces more grain than any other kind. In 1755, the ſheaves of this wheat, of the ſame ſize as thoſe of our common wheat, yielded more grain by half than the others did. It is therefore probable, that the planting of this grain will be attended with advantage, eſpecially in climates not ſubject to too hard froſts.

But what is of very great importance, is, to know well at what degree of maturity this corn ſhould be reaped. The two firſt years that I ſowed any of it, the ears were prodigiouſly big, and full of very plump well-fed grains: but I was uneaſy not to ſee them ripen. They continued green, whilſt I expected daily that they would turn yellow, and the grain grow hard; but in vain. By this delay, the grains waſted ſo much, that I never ſaw any ſmaller, nor ſo much ſhrunk as theſe. However, they ſprouted well when ſowed, and produced very fine plants.

The third year, I determined to reap them ſooner than I had done the firſt. Accordingly, I cut them down as ſoon as I found that the grains had acquired a ſufficient degree of hardneſs, notwithſtanding that the corn was ſtill quite green. The conſequence of this was, that the grains remained exceeding plump and fine.

YEAR 1756.

I Continued to ſow the ſame field with Smyrna wheat, of which I procured ſome quite pure and unmixed. I ſowed 51 pounds of this wheat, the firſt of October. The plants were fine, and ſufficiently forward before winter, and throve prodigiouſly from ſpring till harveſt. But I ought not to omit obſerving, that Smyrna wheat is as apt to be *rickety* as common wheat, and that numbers of theſe plants were affected with that diſtemper.

This crop was reaped the twenty-ninth of July, being ſtill green, and

and the grain only hardened. It yielded 1885 pounds of exceeding fine, clean, good ſized wheat.

OBSERVATIONS.

IT would anſwer no end to make experiments, if one were not to attend to the inſtructions they may afford: but as thoſe inſtructions will ſometimes eſcape the notice even of the moſt careful obſerver, it is proper always to repeat the experiments, and to continue them conſtantly for ſome time. 'Tis by ſo doing, that the advantages of the new huſbandry will appear in their true light, and be eſtabliſhed beyond diſpute.

The field I am now ſpeaking of, and from which I reaped five crops, in five years immediately following one another, preſents us real and very conſiderable advantages, which I ſhall ſet forth in what appears to me the juſteſt and moſt ſtriking manner.

To this end, I ſhall ſtate exactly the products of the field in queſtion, cultivated in the old and in the new way. I ſhall begin with its produce during ſixteen years that it was cultivated according to the rules of the old huſbandry; namely, from the crop of 1730, to that of 1744 incluſively. In this ſpace of time, it produced eight crops; the cuſtom of the country being to ſow but once in two years, and to reſt the ground each alternate year. My account may be depended upon, as perfectly exact. I have extracted it out of a journal kept by a ſteward of mine, who died in 1745, and who was ſcrupulouſly exact even in the ſmalleſt concerns.

After giving the produce of this field, the ſoil of which is very good and ſtrong, during ſixteen years that it was cultivated in the old way; I ſhall ſhew what the ſame field produced in five years cultivation according to the new method, in order to compare the different products of only five years to ſixteen; and afterwards draw a compariſon between both the cultures for ſixteen years, ſuppoſing, which is a great diſadvantage, that the eleven remaining years of the new huſbandry produce no more than theſe firſt five years.

Number I.

Produce of the field Number II, *during sixteen years that it was cultivated in the old way*; viz. *from the crop of the year* 1730, *to that of the year* 1744, *inclusively.*

SOWED.

		Pounds.	Pounds.
In 1729.	. . . .		267
1731.	Wheat	425	488
	Barbary wheat	63	
1733.	Wheat		441
1735.	Wheat		504
1737.	English wheat		441
1739.	Wheat		441
1741.	Wheat		472
1743.	Wheat mixed with tares . . .		504
	Total seed of eight years . .		3558

REAPED.

		Pounds.
In 1730.	. . . .	1134
1732.	A year extremely bad, on account of the great quantity of slugs which destroyed the wheat, and the many seeds of weeds that it was mixed with . . .	1606
1734.	. . . .	1953
1736.	. . . .	1008
1738.	. . . .	977
1740.	. . . .	1291
1742.	. . . .	1638
1744.	. . . .	1512
	Total amount of the crops of eight years, in the space of sixteen years . .	11119

Brought

Brought over; Total amount of the crops of eight years, in the space of sixteen years . .		11119

To be deducted.

	Pounds.	
Siftings of 1732	756	
* Siftings of the other years . . .	1009	
Seed, as above	3558	5323
Remains, for the neat produce of sixteen years, . .		5796

* *This field always produced clean corn, greater pains being taken to keep it free from weeds, than could be bestowed upon other pieces of ground, more distant or more extensive. The siftings would otherwise have been more considerable in so great a number of years.*

Number II.

Produce of the field Number II, during five years of culture in the new way.

SOWED.

		Pounds.	Ounces.
In 1751.	Wheat	11	4
1752.	Wheat	34	14
1753.	Wheat	61	14
1754.	Smyrna wheat	78	
1755.	Smyrna wheat	51	
	Total seed of five years . . .	237	0

REAPED.

	Pounds.	Ounces.
In 1752.	1041	12
1753.	1575	
1754.	1820	
1755.	1950	
1756.	1885	
Total amount of the crops of five years .	8271	12
To be deducted for the seed, as above . .	237	
There was no sifting.		
Remains for the neat produce of the five years	8034	12

Number

Number III.

Comparison of the above produce of the new culture, with that of the old.

	Pounds.	Ounces.
The new husbandry produced in five years, without any intermediate year of rest . .	8034	12
The old husbandry produced, in sixteen years, .	5796	
Consequently the new husbandry produced in five years, more than the old did in sixteen, by . : . . .	2238	12

Number IV.

Farther comparison of the produce of the new husbandry with that of the old, as above.

NEW HUSBANDRY.

	Pounds.	Ounces.
The new husbandry produced in five years .	8034	12
Supposing the crops to be the same for eleven years more, they would amount to .	17676	7
And for sixteen years, to . :	25711	3

OLD HUSBANDRY.

The neat produce of the old husbandry, in sixteen years, was . . .	5796	
The balance in favour of the new husbandry, would consequently be, in sixteen years .	19915	3

REFLECTIONS and OBSERVATIONS.

I Dare to say that very few of those who might just have glanced over the products of the five years during which the field No. 2. was

was cultivated in the new way, would have imagined the advantage to be near ſo great as it really is, had not the above compariſons been likewiſe laid before them. If nothing but the hope of great profit can recommend the new huſbandry to the general practice of our farmers, the above calculations ought at once to determine them; ſince they here ſee that the ſame field produced much more grain in five years, and even in four, when managed in the new way; than it produced before in ſixteen years, whilſt cultivated according to the old method. I confeſs that when I firſt began to practiſe the new huſbandry, I did not expect ſo great advantages. They might have been greater ſtill, if I had not committed in the firſt years, faults which conſiderably diminiſhed the crops of 1752 and 1753. Beſides thoſe firſt faults, I committed another which greatly leſſened my crops. I was not aware that *every field that is plowed deeper than it has uſually been, often loſes of its fertility for ſome years, unleſs it be aſſiſted by a ſufficient quantity of manure.* The new earth which is brought up to the ſurface by theſe plowings, remains ſo hard and compact that it cannot be fit for the nouriſhment of plants, till after it has been well broken by repeated plowings, and as it were ripened by the influence of the air, *&c.*

This obſervation will be particularly uſeful to all beginners in the new huſbandry. They muſt not be ſurpriſed if their firſt crops do not anſwer their wiſhes: but the deeper they plow at firſt, the greater ſucceſs they may juſtly expect afterwards. In the mean time they muſt ſuffer patiently the inconvenience I have been ſpeaking of, or remedy it by uſing a great deal of manure.

Would it be reaſonable to deſire greater advantages than thoſe we have proved above? any man of ſenſe may ſurely be ſatisfied with them. But by what fatality does it happen, that infinite numbers will not, or cannot ſee them? I know, for inſtance, that except a certain number of perſons who have ſtudied the new huſbandry thoroughly, or practiſed it with care, it is generally thought in this country, that the field No. 2. which I have been ſpeaking of, has produced me leſs corn than it would have done if it had continued to be cultivated in the old way. Whence does this notion ariſe: Surely from this, *that men are apt to judge too precipitately, without examining ſufficiently, or calculating right.* Whoever really wiſhes to be informed, and deſires to promote the public welfare, and his own private good, may eaſily attain thoſe ends: but it muſt be by a dif-

different road from that which is commonly purſued: it muſt be by reckoning and calculating, as I have done with regard to the field in queſtion.

Some fields will not yield ſo much as this has done: but yet their produce will be ſuch as muſt determine all unprejudiced perſons in favour of the new huſbandry, as I ſhall demonſtrate by the calculations in the third and fourth articles.

EXPERIMENT, No. III.

N. B. *The field on which this experiment was made, contains an arpent. I have joined it to that of the experiment No. 7, under which its produce is included.*

EXPERIMENT, No. IV.

Sowed		lb.	oz.		lb.	oz
In 1753		181		reaped	3370	
1754		268	14		4972	8
1755	1ſt half	488			5850	
	2d half	488			2080	
1756		816			3640	

YEAR 1755.

ONE half of this field was laid out in beds in 1753, and the other half, not till 1754. I ſhall begin with the oldeſt, from which I ought to expect the beſt crop, the ground being beſt prepared. It was ſowed the 27th and 28th of Auguſt, with 488 pounds of wheat. This was a conſiderable increaſe of ſeed. I judged it neceſſary, and ſo it proved; for it preſerved this field from being greatly hurt by the froſts in winter, which deſtroyed a great number of plants. If they had not been ſo thick ſown, I make no doubt but that the crop would have been conſiderably diminiſhed. This half was reaped the 18th of July, and yielded 5850 pounds of very fine grain. Here is a crop conſiderably greater than the former. It exceeds the firſt by 2480 pounds.

The other half of this field now bore its ſecond crop. The ſame quantity of ſeed (418 lb.) was ſowed, but did not produce ſo much

as

as in the other half. As this part lies in a bottom, the froſt hurt it more than it did the other, nor had it been ſo long laid out in beds; beſides which, the rains hindered me from ſowing it at the ſame time as the other half. It could not be ſowed till the 21ſt, 22d, 23d, and 24th of October, which is ſomewhat late: It was reaped the 19th of July, and yielded 2080 pounds of wheat.

YEAR 1756.

THIS field was ſowed the 9th, 10th, and 12th of September, with 816 pounds of wheat, and reaped the 28th and 29th of July. The produce was 3640 pounds:

OBSERVATIONS.

ONE might juſtly be ſurprized at the ſcantineſs of this crop, if, beſides, what I ſaid before, of the general cauſes which were ſo prejudicial to this year's crop, I did not add thoſe which may have more particularly affected this field. My intention was to ſow it thicker than it chanced to be, by the ſower's not following my directions. The hurt might perhaps not have been great, if the year had proved kindly: but it was of great conſequence this year, and particularly in this field, in which all the corn was extremely *rickety*.

EXPERIMENT. No. V.

Sowed	lb.	Reaped lb.
In 1753	139	2205
1754	224	2283
1755	388	2600
1756	544	2700

YEAR 1755.

THIS field ſtill continued to be difficult to bring to good tilth; and therefore required the more ſeed. It was ſowed the 29th of Auguſt, reaped the 29th of July, and produced 2600 pounds of grain.

YEAR 1756.

I Thought it neceſſary to continue to increaſe the ſeed of this field. It was ſowed the 20th and 22d of September, with 544 pounds of wheat. The young plants looked very fine before winter, and promifed better than thofe of the preceding years. The general accidents of the year affected them. They were reaped the 26th of July, and yielded 2700 pounds of corn.

EXPERIMENT, No. VI.

Sowed.		lb.	Reaped lb.
For 1753		45	724
1754		82	798
1755	wheat	126	900
	barley	12	nothing
1756	beans and tares	153	value in wheat 780

YEAR 1755.

THIS field is one of thofe in which the ftiffnefs of the foil refifted longeft that degree of pulverifation in which the chief merit of the new hufbandry confifts. The firft crops were not confiderable. In 1754, I could not fow this ground before the 15th of October, and yet the plants which it produced were very fine. It was reaped the 21ft of July, and produced 900 pounds of wheat.

The moft remarkable thing in this field, was what happened to fome beds which I had fowed with 12 pounds of barley. The young plants were exceeding fine in autumn, but the hard frofts of the winter killed every one of them.

As foon as I perceived this lofs, I endeavoured to repair it, by fowing the fame beds again with fpring barley: and as the two wheat beds next to them had likewife fuffered fo much as to have but few plants left, I fowed them alfo with barley.

Thefe beds were fowed without being plowed again. The whole charge of this fecond fowing confifted in paffing the drill once over them, and in 28 pounds weight of barley which was ufed for the feed. This was done the 8th of April.

This barley grew very fine. It was reaped the firft of Auguft, and yielded 270 pounds of grain. I doubt whether that which was fowed before the winter, could have produced more: fo that I think this crop made me ample amends for the lofs of my firft feed.

How great a proof is this of the excellence of the new hufbandry! and how eafy a means does this hufbandry afford, of guarding againft dearth, when our young crops chance to be deftroyed, by the facility with which the fame lands may be fowed again, without lofs of time,

time, and with ſcarce any more expence than the bare coſt of other ſeed, which, in ſuch times of general diſtreſs, will produce crops of other uſeful grains, even more profitable than thoſe of wheat.

An ineſtimable advantage, which ſecures the ſubſiſtence of the people, and which cannot be obtained by the old huſbandry. This muſt be evident to every one who conſiders that all that is requiſite, in ſuch a caſe, in the new huſbandry, is only to ſow again; whereas in the old way, the huſbandman is obliged to plow before he ſows, to ſow a great deal of ſeed, and to harrow that ſeed in after it is ſown. The vaſt ſaving made in the ſeed, in the new way, is likewiſe another very important article in a time of ſcarcity.

I reaſon here upon a ſuppoſition of the total loſs of all the crops of wheat; which really was the caſe in 1709.

YEAR 1756.

I Reſerved this field to ſow it in the ſpring, with the grain of that ſeaſon, which I had not yet made any experiment with, except in ſmall ſpots of ground. I plowed it before winter: the new beds were well made, and the earth was in ſuch fine tilth in the ſpring, that I thought I might ſafely ſow it without any farther plowing. Accordingly I did ſo, the 26th of April; the too great wetneſs of the earth not permitting it to be done ſooner. One half of this field was ſowed with beans, and the other half with tares; in all, 153 pounds of both; which produced a crop equal in value to 780 pounds of wheat.

OBSERVATIONS.

THIS year was extremely bad for all grains ſown in the ſpring: moſt of which yielded but the value of the ſeed: ſo that the produce of this field, compared to that of others cultivated in the old way, ought to appear very conſiderable.

The ſucceſs of this experiment ſhews, that when too much rain, or too great drought hinders plowing the land in due time, and ſome fields cannot be prepared for wheat in the autumn, they may be ſowed the ſpring following with the different grains uſually planted in March.

EXPERIMENT. No. VII.

	Sowed lb.	Reaped lb.
For 1753	412	2646
1754	360	2467
1755 including the experiment, No. 3	639	4290
1756	1010	6760

YEAR 1755.

THE ſoil of this field is of ſuch a nature as to require a greater quantity of feed than many others. I ſhall doubtleſs be thought to have increaſed it greatly, in having enlarged that quantity to 639 pounds, and yet this year's experiment makes me judge, that it will ſtill be neceſſary to ſow more another time.

I ſowed this field the 9th, 10th, and 26th of Auguſt, and reaped it the 16th and 17th of July. It yielded 4290 pounds of grain.

YEAR 1756.

I Have a meadow adjoining to this field. I plowed up part of it, which had produced but very little graſs for a long time, and turned it into arable land. This addition ſerved to replace another part of the field, which I ſowed with luſerne. This laſt part being leſs than that which was added from the meadow, the field may have been enlarged about an arpent and a half, or two arpents, and the ſoil is much the better for it.

This field was ſowed with 1010 pounds of wheat, the 10th, 13th, and 15th of September, and was reaped the 23d and 24th of July, when it produced 6760 pound weight of corn.

EXPERIMENT. No. VIII.

	lb. oz.		lb.
For 1754 was ſowed	76 8	which yielded	1462
1755	157		1300
1756	230		2080

YEAR 1755.

THIS great increaſe of the quantity of the ſeed might be wondered at, if I did not obſerve that this field was ſowed with a double turn of the drill-plough; by which means each bed (for they were all wide enough to admit of it) had ſix rows of plants inſtead of three, and conſequently took up double the quantity of ſeed. The event will ſhew that I was right in ſo doing.

The field was ſowed the 31ſt of Auguſt, with 157 pounds of wheat. Nothing could make a finer appearance than this field did at the beginning of winter. The plants, which had already branched very abundantly, made the ground look ſurpriſingly thick covered. The ſtrength of the ſtems, and the deep green of the blades made me expect extraordinary ſucceſs. They continued thus promiſing during all the winter; and the ſame in February and March, and to the middle of April.

The ſoil of this field is excellent: but it could not be preſerved from the fatal effect of the ſevere froſts in winter. I was extremely ſurpriſed when, going thither the 27th of April, I found this wheat, which I had ſeen twelve days before without the leaſt ſymptom of decay, reduced to a moſt deplorable condition: not a ſingle ſtalk remained that was not dead, nor a blade that was not withered. Both the ſtalks and the blades adhered ſo little to the plants, that one might rake them up in heaps, like graſs that has been mowed: in ſhort, nothing could be more melancholy than the appearance of this field.

The earth was extremely dry, and the weather very hot for the ſeaſon: from the 16th to the 24th of April, M. de Reaumur's thermometer was almoſt always at ſeven o'clock in the morning, from 15 to 18 degrees above the freezing point. I am apt to think that this uncommon temperature of the air compleated what the hard froſts had begun, and which I did not perceive before.

My firſt thought was, to ſow the field again with barley, as I had done in the caſe of the experiment, No. VI. but ſeeing that the diſaſter was general, I examined moſt of the plants with great attention. I ordered the earth to be dug, and found ſome plants quite dead, and others, in pretty great number, which had ſtill ſome vigour, and were provided with very good roots, and of which only the ſtems and blades had periſhed. This gave me ſome hope, which was not a little ſtrengthened by my perceiving that ſeveral of theſe plants were ready to produce new ſhoots, ſome of which could juſt be diſtinguiſhed by their white point, ſcarcely perceptible, others were about the 12th part of an inch long, and others a quarter or half an inch: theſe laſt began to look green.

Several reaſons induced me to think that theſe plants might ſtill be ſtrong enough to produce new ſtalks, eſpecially if a little rain ſhould chance to fall. I therefore reſolved not to ſow this field again. Fortunately, a good ſhower of rain fell the 29th, which did them a wonderful ſervice. I went to ſee them ſoon after, and found the new ſhoots conſiderably grown: upon which I determined to cultivate the beds with care. By the middle of May, they were grown very fine, were loaded with blades and ſtalks, and only ſeemed much thinner than in the autumn: the ſtraw was as long, the ears as big, and as full of grain as the year before. I was obliged to reap this corn early; becauſe, as the heat of the weather had precipitated the ripening of the grain, it might have ſhrunk and ſhrivelled if I had let it ſtand ſome days longer. It was cut down the 17th of July, and yielded 1300 pound weight of grain.

I am perſuaded that this accident diminiſhed the crop by above half; and this is certainly the reaſon why it produced leſs than that of 1754.

The ſhape of this field was irregular on the north ſide. The length of the beds in that part decreaſed progreſſively, ſo that thoſe next the end were not above three or four perches long. This made the tilling of them very troubleſome, becauſe of the frequent neceſſity of turning the plough. I ordered this triangular part, which was about a third of the field, to be plowed for ſowing in equally diſtant rows with the drill-plough. The reſt was preſerved in beds, as in the preceding years.

I ſowed it the 17th of September, with 230 pounds of wheat, which was reaped the 24th of July, and yielded 2080 pounds of grain.

EXPERIMENT, No. IX.

	lb.	oz.		lb.
For 1754 was ſowed .	249	12	which yielded	2925
1755 . .	312		. . .	1362
1756 . .	295		. . .	2219

YEAR

Year 1755.

THIS field, which had been well prepared, was ſowed the 27th of Auguſt, with 312 pounds of wheat, which grew very fine and thick till November: but from the 10th to the 18th of that month, a general *ruſt* ſeized it. I imputed to this diſtemper the ſmallneſs of the crop, which amounted only to 1362 pounds.

Year 1756.

THE ground was extremely well prepared, and better than the preceding years. It was ſowed the 24th of September with 295 pounds of wheat, which produced 2219 pounds. It was reaped the 21ſt of July.

EXPERIMENT, No. X.

			lb.		lb.
For	1754	was ſowed	294	which yielded	3055
	1755	. .	397	. . .	2210
	1756	rye .	348	. . :	2700

Year 1755.

THIS field was ſowed the 30th of Auguſt, with 397 pounds of wheat, which produced 2210 pounds. I make the ſame remarks on this experiment, as on the preceding No. IX. year 1755.

Year 1756.

THOUGH it is not uſual for me to ſow rye, becauſe all my lands are fit to bear wheat, I was willing to make a trial with that grain; and accordingly I ſowed this field with it, the 16th of September. The quantity employed was 348 pounds. The ſtraw was very long, and much thicker than that of rye in the common way: the grains too were conſiderably larger. It was reaped the 19th and 20th of July, and yielded 2219 pounds of grain.

EX-

EXPERIMENT, No. XI.

Executed by the ſame perſon who made thoſe of 1754, marked with the ſame number, and thoſe of 1753 marked No. IX.

THOUGH the following extract does not agree exactly with the title of this article, I was unwilling to make a ſeparate one of it. It contains very intereſting details: the moſt eſſential circumſtances are related with great preciſion; and the conſequences of the reſults are eſtabliſhed by very inſtructing calculations. They ſhew the writer of them to be a ſtudious huſbandman, a very ſkilful naturaliſt, a zealous lover of the public good, who inſtructs by his example, and ſtill more by his knowledge.

Theſe experiments were made about fifteen miles from Geneva, in a country where it is the cuſtom to ſow their land two years running. The firſt year, it is ſowed with wheat; the ſecond, with ſpring corn, and the third, it is reſted.

Extract of a letter dated December 7th, 1755.

"I received the journal of your laſt year's experiments, and have "read it with very great pleaſure. If it were poſſible for me to "make any obſervation of the leaſt importance, upon your experi- "ments, which had eſcaped you, I ſhould take the liberty to lay it "before you, perſuaded that you would receive it kindly.

"In general, I aſcribe, as you have done, the different ſucceſs of "the new huſbandry, 1. To the intrinſic quality of the ſoils, ſome of "which ſeem unfit for the production of wheat; 2. To the condition "of the lands, when they firſt began to be cultivated in the new "way: 3. To the manner in which they were prepared according to "the principles of this huſbandry: and laſtly, to the quantity of "ſeed that was uſed.

"I was particularly pleaſed with your experiment on the barley. "It is certainly very inſtructing, and confirms what I before ſuſ- "pected, that, in our climate, wheat and other plants love ſociety; and "that they thrive better when numbers of them are planted together, "than they would do ſeparately, provided that number be not too "great. You will certainly not fail to repeat that experiment in "years leſs hot and leſs dry, and upon other plants. Still I am "afraid that no fixed rule can ever be given in relation to the quantity "of the ſeed: too many circumſtances influence the condition of the

"ſoil;

" foil: but it will always be of great fervice to fix certain bounds,
" within which every one may chufe what fuits him beft.

" You will fee by the account of my little experiments, that I " have fowed in the ground of my rows, nearly what would have " been fowed by hand in the fame fpace. But the imperfection of " my drill-plough, and the condition of my land, obliged me fo to " do; and I have not hitherto found any inconvenience from it.

" I have not yet been able to try the goodnefs of your experiments " upon luferne. My land was not fufficiently prepared for me to " expect fuccefs: I am obliged to defer it till next autumn, when " all my fields will be under the new hufbandry.

" Only one thing puzzles me with regard to your rows of luferne, " and that is, the manner of making the fodder. How can it be cut " and dried conveniently?

I fhorten my reflections, and proceed to my experiments.

Produce of the firft and fecond crop of a field cultivated in the new way.

" This field contains, according to our meafure, fix *pofes*. Each " *pofe* contains 400 fquare perches, and each perch nine feet: fo that " the whole extent of this field is 5400 perches, of fix feet to the " perch.

" The foil is tolerably good; rather light than ftrong; fitter for " rye than for wheat. I am the firft that ever ventured to fow it " with wheat. Dung ufed to have a great effect upon it for the " firft crop; but the fecond feldom fucceeded: in fhort, it was the " general opinion that nothing could be made of this field without " the help of a deal of good manure.

" It was well dunged in 1749, and fowed with Maflin corn. " The year 1750 was very favourable to corn in general, and parti- " cularly to that of this field. It yielded as much as two middling " crops; that is to fay, ten for one: but being fowed again the " fame year, it yielded in 1751, but two and an half for one. The " year 1752 was the year of reft, or rather it was plowed that year, " according to the old method, and fown in the broad-caft way, but " without dung. The autumn was not kindly: the plants rofe " poorly; and the crop of 1753 yielded fcarce three for one, after " deducting the tythe. It was after this crop that this field was laid " out in beds of fix feet wide, and fowed the fame year with wheat.

" As the mould of theſe beds could not be prepared properly, and " the year 1754 was but a poor one for wheat, I was not ſurpriſed at " the ſcantineſs of the crop. I ſowed 12 of our meaſures, and reaped " 72. Our meaſure of wheat weighs, when it is good, 28 pounds; " and that of Maſlin, 26 pounds. I did not weigh mine every year; " but I am ſure it was always full weight.

" Encouraged, rather than diſheartened, by this trial, I plowed " theſe beds up for a new crop, and ſowed them, part with Maſlin " corn, and part with wheat.

" The ſummer of 1754 was ſo dry, that I deferred plowing the " back of the beds which had born their crops, till the end of " autumn. This was attended with theſe two inconveniencies: firſt, " that the intermediate earth, which had been well pulveriſed, being " no longer ſupported as before, ſlipt away from under the drill, " and ſpread to the right and left; by which means the plants had " leſs depth of good mould left, and I loſt part of the advantage I " hoped for from this culture. The other inconvenience was, that " the beds being no longer ſo high raiſed as they ſhould have been, " the firſt plowing in autumn covered their outmoſt rows in ſeveral " places: a loſs, by ſo much the more conſiderable, as the rows ſo " buried would, by their ſituation, have otherwiſe been the fineſt of " all. I certainly under-rate it in valuing it at only a tenth of the " crop.

" As Maſlin is a much quicker grower than wheat, and being " uncertain whether it could do without dung; out of 18 beds, I " dunged 12, but very ſlightly; juſt as I would have dunged the " third part of this ground, if I had intended to ſow it in the broad- " caſt-way.

" I ſowed it the 4th and 5th of October, 1754, with two turns " of the drill-plough, and very thick, by reaſon of the imperfection " of my drill, and becauſe the ſeaſon was already ſomewhat advanced. " A third more ſeed was ſowed this year than the laſt, *viz.* 18 of our " meaſures.

" The plants roſe well, the rows looked very thick and well " filled, except thoſe which were hurt by the firſt autumn plowing, " and by cattle which broke in upon the ground, and did a deal of " damage.

" The plants in the part which had been dunged, were very fine " all the winter. In the beginning of April they grew with ſurpri- " ſing vigour, and were as fine as could poſſibly be in May and

" June.

" June. They were so tall, that they hid my plough and horses, " and seemed to promise three times more than the other plants where " the ground had not been dunged. These last grew more slowly, " but just before harvest, they pushed strongly; and if their straw " was not so long or so thick as that of the former, there was scarce " any difference in the length of the ears, and the difference of the " produce was but one fourth in favour of the dunged plants.

" Both the one and the other suffered the 23d of May, by a violent " north-east wind, which broke a great number of the stalks of the " rye, and tore others up by the roots. The stalks that were " not quite broke, recovered perfectly, and the loss was not great " with respect to them. The case was different in regard to the " plants that were broke asunder or torn up. I reckoned the damage " sustained by these last, equal to a tenth part of the crop.

" Of the 47 furrows of this field, 18 sowed with maslin yielded " me (exclusive of the tythe which is an eleventh part) 60 of our " measures. This grain is the finest of its kind in the whole country, " and is equal to the common wheat. It weighed in the driest and " coldest season, 27 pounds; which is a ninth part more than the " common maslin.

" The 29 furrows sowed with wheat, seemed to have escaped the " violent frosts of the winter: but I was greatly surprized in April, " to see large spaces in which the plants perished daily; and " others wherein the wheat seemed to have disappeared, to make " room for a prodigious quantity of senvy which looked extremely " well*.

" I was not at all pleased with this change of crop, and though I " no longer expected any thing from these damaged places, which " amounted to the value of nine furrows, I would not give up the " good plants which I thought might still be in them; and therefore " ordered them to be weeded carefully and several times over, by " women who desired only the weeds for their labour. This ope- " ration was not useless: the surviving plants gathered new strength: " they branched considerably in June; and yielded me, at harvest, " about a third part of what I reaped from the places which had not

* Great part of this field seems to have suffered exactly the same accident which happened to the whole field of the experiment, No. 8. It was not perceived in either of them, till April; and the effect was the same upon the plants in both cases, tho' they were more affected in one than in the other. In both cases too, the plants recovered and yielded a good crop.

" been damaged. These last seemed but indifferent during all the " spring. Every one judged this corn inferior to that of the " fields which had been sown in equally distant rows and dunged: " but from the beginning of June, when the other wheat began to " decline, my rows throve so well, that some parts of them were " very greatly superior, both in the length of the straw, and the big- " ness of the ears, which last were every where longer and better " filled.

" Notwithstanding all this, my wheat had still more to suffer. It " was cut just before the heavy rains in July, and some of it sprouted, " as was the case elsewhere. Besides the loss in the quality of the " grain, my threshers reckoned that the quantity of it was diminished " eight measures. The whole produce was but 68 measures, after " deducting the tythe.

" I have entered into this detail, in order to make the following " remarks:

" 1. This field, twelve furrows excepted, not having been dunged " so early as in the year 1749, the superiority of the crop of 1755 over " that of 1754, must be imputed chiefly to the new husbandry. The " places on which my finest wheat grew, were not at all ex- " traordinary in 1754, and yet they were not dunged for 1755: con- " sequently the culture, far from exhausting, meliorated the ground.

" 2. Some soils are fitter to produce some grains than others; " and it is vain to attempt to force nature. Notwithstand- " ing the good culture, the bad part of my field was yet worse " than in 1754; but the senvy in it was finer. I sowed this part " with grass, and it is still covered with the same plants, very green " and vigorous. I judge that rhadishes or turneps could do very " well there.

" 3. The greatest use of dung is to shelter the young plants from " the winter's cold and the extraordinary droughts of the spring: " perhaps too it may serve to correct the defect of the soil.

" 4. One must not always judge of a crop, by the appearance of " the green corn in April and May; because the dung then exerts " its greatest strength for the production of the blades, and that ap- " pearance is oftentimes deceitful.

" 5. The last plowings ought, if possible, never to be neglected: " 'tis to them that I ascribe the favourable change which happened to " my wheat.

" To follow your method, I have now only to compare the pro-

" duce

" duce of this field, with what it yielded when cultivated in the old " way. I have not been able to find its exact product before the year " 1750. All I know, is, that the crops varied extremely, according as the ground had, or had not been dunged, or the year was " more or less kindly.

" I shall therefore estimate the product of this, by that of the " neighbouring fields, which are thought to bear a good crop, when " a *pose* of land yields 32 of our measures, after deducting the tythe " and seed-corn. The next crop, whether it be of winter or of " spring corn, is seldom worth half the first: however, supposing it " to be 16 measures, as the land is rested the third year, the neat " produce of the crop for three years will be 48 measures; which is " 16 measures a year, and 96 measures for the six *poses*.

" I had, in the new way, 128 measures of wheat and maslin; " deducting from which 18 measures for the seed, there remain " neat 110 measures, and a profit of 14; for which I am indebted " to the new husbandry.

" If we add to this, the eight measures lost by the sprouting " of the grain, and the damage done by the plowing in autumn, it " will appear that, without those two extraordinary accidents, I " should have had 35 measures more than could have been expected " in the old way, and that of a corn, which, supposing all other " things equal, is worth 12 *per cent.* more than any of the common " growth.

" I make no doubt but that if I were to lay upon my furrows the " dung that is spread yearly upon my lands, and were to take all the " precautions necessary to sow and cultivate them properly, the neat " produce would be 30 measures, one year with another; which " would be a continual plenty.

" However that may be, thus much is certain in favour of the " new husbandry, that, notwithstanding all the accidents, my field " produced the second year about double the quantity that it did the " first.

First year's produce of a field sowed and cultivated according to the new husbandry.

" This field contains about 1900 of our perches, or 4200 perches " of six feet to the perch. It was divided into beds five feet wide, " which were sown alternately with one and with two turns of the " drill-plough, that is to say, with three rows and with six. The

" plowings

" plowings had been but badly performed, and the beds were not
" raiſed or arched ſo high as they ſhould have been. Thoſe that
" were ſown double, that is with ſix rows, were always ſuperior to
" the reſt. As the ſoil of this field is generally ſtrong and fit for
" wheat, it did not afford the ſame variations as the former; though
" ſome of this wheat ſprouted too.

" I ſowed 17 meaſures, and reaped 92, beſides the tythe. By the
" ſame calculation as before, the neat produce was one meaſure leſs
" than in the old way.

" But it is to be obſerved, 1. That by the ſprouting of the grain,
" I loſt more in this field than in the other. 2. That this was not a
" good year for wheat. 3. That this field, being bordered by two
" highways, and not being incloſed, was greatly damaged by cattle
" that got into it. 4. That what grain I did reap was clean, and
" ſuffered ſcarce any diminution by ſifting. 5. That if I had ſowed
" all my beds with ſix rows, I ſhould probably have reaped a fourth
" part more: ſo that no blame ought to be imputed here to the new
" huſbandry. 6. That it is the firſt year of my trying this
" huſbandry; that my ground had been but very imperfectly prepa-
" red; and that it is now in a much better condition for the next
" crop, though my ſervants have again committed ſeveral faults.
" All theſe conſiderations ſeem to me farther proofs of the excellence
" of the new huſbandry.

" I could prove that, in point of profit, this laſt field has yielded
" me three times as much as it uſed to do in the old way, and the
" other field, twice as much.

" This may more than ſuffice for ſuch ſmall experiments as mine.
" I could wiſh they had been greater, and the ſucceſs more complete.
" With what pleaſure ſhould I offer them to you, whom I look upon
" as the chief and patron of all who follow the true principles
" of agriculture!

" Though I have turned the bad parts of the firſt field I ſpoke of
" into graſs, I have added three *poſes* more to the arable, againſt next
" year, in order to cultivate them in the new way; which I purpoſe
" extending to all my lands the next ſowing ſeaſon.

" I have, very injudiciouſly, I doubt, ſowed between twelve and
" thirteen *poſes* with grain which had ſprouted. I don't believe
" the third part of it has come up: but as I ſowed thick, and my
" lands are much better prepared than they were laſt year, I hope to
" have at leaſt as good a crop."

OBSERVATIONS.

WHEN experiments have been repeated in different places, the circumstances attending them ought to be greatly considered: for if these have been alike, and the event is the same, they serve to establish one another, and merit our confidence in them. The comparison of the last experiments, with mine, gives me room to make two important observations. The first is, that both of us have perceived, and for the same reasons, the necessity of sowing a greater quantity of seed, than we did in our first experiments. This augmentation produced better crops. We may therefore now lay down, as a rule founded on experience, that the quantity of the seed must be what we said in our last memoirs, regard being had to the particular considerations mentioned therein.

The second observation is, that both of us have sowed beds with two turns of the drill-plough, that is, with six rows of corn, and the event in both cases has been, that the same extent of ground has always produced a greater quantity of grain. It is therefore probable that this method will be found to be the best.

But as it is possible that the effect may not be the same in different countries, a trial may be made by sowing some beds with three rows, and others with six, and which ever answers best, may afterwards be practised.

These two observations will be confirmed by some experiments which we shall give in the fifth article.

Other business prevented this lover of agriculture from following his experiments in 1756, with the same attention as before. The exact, tho' short account which we shall give of them, may serve for a sequel to what we have been able to collect in relation to those which he made in 1755.

YEAR 1756.

IN the first place, the field of six *poses*, or 5400 perches, which bore a crop in 1754, and another in 1755, and which had not been dunged at all since the year 1749, being surrounded by a greater piece of land, which is sowed, sometimes with wheat, and sometimes with artificial grasses, was plowed in August, immediately after harvest, and sowed with *sain-foin*. The crop of 1756 was very fine,

each

each *pose* yielding from 25 to 30 hundred weight of hay, at the firſt mowing, and half as much at the ſecond. *Therefore the new huſbandry preſerved the ground in good condition, without the help of dung; and its productions do not ſeem to have exhauſted the ſoil.*

The field of about five *poſes*, or 4200 perches, ſowed with wheat, and which produced 92 meaſures of that grain in 1755, produced but 61 in 1756. The inferiority of this crop muſt be aſcribed, 1. To the error of ſowing wheat that had ſprouted, which, in the opinion of all judges, occaſioned a diminution of at leaſt one fourth; 2. To the damage done by cattle, (this field lying quite open to them) which was greater this year than it had ever been before; part of the green corn being eaten down twice: this loſs is valued at a tenth part of the crop, independent of the tythe. 3. That the ears were not ſo full of grain this year, in this country, as they had uſed to be: there was as much ſtraw, within ſeven truſſes and a half, as in 1755; but the corn ran leſs into grain, tho' it ſtill had more than the common wheat.

Upon the whole, all loſſes and accidents deducted, the crop was worth double what the land would have let for.

This field is now under wheat, which looks extremely fine, except one *poſe*, which muſt be ſowed again with ſomething elſe, on account of the damage the cattle have done to it. The owner of this field intends to continue ſowing it without dung, as long as any heart remains in it; *in order*, ſays he, *to confirm myſelf in what I now think; or to find out my error, if I am miſtaken.*

Another field of betwixt nine and ten *poſes*, or about 9500 perches, produced 160 meaſures of wheat; but ſome loads of dung had been laid upon it. However, even the places which had not been dunged, produced much ſtronger ſtraw than they did the years before, in which they were ſown by hand. 'Tis true that the dung made the ſtraw ſtronger, but the years did not yield either more, or finer grain. This was likewiſe ſowed with ſprouted corn: but the ſeed was better this year, and accordingly there is a proſpect of a greater crop.

ARTICLE II.

Experiments made on lands sown in equally distant rows with the drill-plough; with some reflections on the advantages of this practice.

EXPERIMENT. No. XVII.

A Large extent of land, near Geneva, continued to be sown with the drill-plough, in equally distant rows. I could instance the products of a multitude of experiments, to prove that the fields sowed in this manner, have always produced much greater crops than those which have been sown in the common way.

I shall mention only a few experiments this year: but they are such as have been made on large tracts of ground, and consequently are more decisive than small ones, of which we have already given a sufficient number in the foregoing journals.

I shall call this No. XVII, because it was made by the same person and in the same places, as that which is marked No. XVII in the year 1754. I need not repeat what I then said of the situation and quality of the lands.

This experiment contains the products of three different farms. About 63 arpents were cultivated in the first, 30 in the second, and 23 in the third: in all, 116 arpents, which were sown with wheat in September and October.

YEAR 1755.

Quantity of seed generally used in the old way.	First farm	16002 lb.
	Second farm	7560 lb.
	Third farm	5922 lb.
	Total	29484 lb.
Quantity of seed used with the drill-plough.	First farm	7812 lb.
	Second farm	3276 lb.
	Third farm	3150 lb.
	Total	14238 lb.
Saved in the seed		15246 lb.

Crops of 1755.	First farm . . .	80210 lb.
	Second farm . .	27690 lb.
	Third farm , . .	27040 lb.
Total of the crops.		134940 lb.
To which if we add the saving in the seed, *viz.*		15246 lb.
The whole produce will be . .		150186 lb.

I shall now examine what these three farms would have produced, if they had been cultivated in the old way, supposing their crops to have been equal to those of 1754, which is much in favour of the old husbandry.

I find that these three farms, which contain about 116 arpents, and which would have required 29484 pounds of seed, would have produced at most from 75000 to 80000 pounds of wheat; which is 54940 pounds less than what was reaped in the new way. The following calculation of the real and effective products in both ways, deducting from each the necessary quantity of seed, will shew the advantage of the new husbandry in a yet stronger light.

NEW HUSBANDRY.

Total produce	134940 lb.
To be deducted for the seed . . .	14238 lb.
Neat produce	120702 lb.

OLD HUSBANDRY.

Total produce	80000 lb.
To be deducted for the seed . .	29484 lb.
Neat produce	50516 lb.
Consequently the balance in favour of the new husbandry is	70186 lb.

This

This may perhaps seem surprising to many: but my calculation may be the more safely depended on, as I have favoured the old husbandry greatly in my estimate of the crops in that way, and have made no deduction for the loss by sifting, winnowing, &c. which, even in the very best years, is always considerably greater in the old husbandry, than in the new.

YEAR 1756.

THE same farms continued to be sown with the drill-plough. I shall therefore repeat the same calculations, to shew the constant advantage of the new husbandry, which is so much the more remarkable this year, as the corn in the common way yielded but very bad crops. The fields in general produced but few sheaves, and the sheaves very little grain, and even that was very poor in many places.

About 80 arpents were cultivated in the first farm, for the crop of this year; in the second 30, and in the third 40: in all 150 arpents, which were sown with wheat in September and October. About twenty arpents had been dunged.

Quantity of seed generally used in the old way.	First farm	20160 lb.
	Second farm	7560 lb.
	Third farm	10080 lb.
	In all	37800 lb.

Quantity of seed used with the drill-plough.	First farm	9828 lb.
	Second farm	3654 lb.
	Third farm	5040 lb.
	In all	18522 lb.
Saved in the seed		19278 lb.
		37800 lb.

Crops

Crops of 1756.	First farm . . .	79560 lb.
	Second farm* . . .	19110 lb.
	Third farm . . .	31590 lb.
	Total of the crops . .	130260 lb.
	To which if we add the saving in the seed, *viz.*	19278 lb.
	The whole produce will be . .	149538 lb.

* *This farm did not produce so much corn as it should have done, because near a third part of the fields was almost totally ruined by inundations.*

Supposing this accident not to have happened, what might these fields have produced? If they had been sown in the common way, these same fields would have yielded less grain than in the two preceding years. I have estimated it at somewhat less than that, and the advantage is still in favour of the new husbandry. These three farms would have produced at most from 88000 to 93000 pounds of wheat; and according to this estimation, which I think a great allowance, the whole crop would be 37260 pounds less than it was.

To see the exact result, let us continue our calculations, deducting the grain that was used for seed.

NEW HUSBANDRY.

Total produce . . .	130260 lb.
To be deducted for the seed . .	18522 lb.
Neat produce . . .	111738 lb.

OLD HUSBANDRY.

Total produce . . .	93000 lb.
To be deducted for the seed . .	37800 lb.
Neat produce . . .	55200 lb.
Consequently the balance in favour of the new husbandry is	75060 lb.

All

All these calculations prove, year after year, the advantage of using the drill-plough. To shew how great that advantage is, I shall briefly recapitulate what is most essential in this article.

RECAPITULATION.

WE have seen a very considerable experiment repeated three years running, and always attended with great success. I shall now sum up the essential and decisive facts, which are so many unexceptionable witnesses, who depose, *That it is much more profitable to sow lands with the drill-plough, than to sow them in the common way.*

To this end, I resume the neat products of the crops.

NEW HUSBANDRY.

Neat PRODUCE of the three FARMS.

	Pounds.
In 1754.	93418
1755.	120702
1756.	111738
Total neat produce of three years	325858

OLD HUSBANDRY.

	Pounds.
In 1754.	62200
1755.	50516
1756.	55200
Total neat produce of three years	167916
The difference in favour of the new husbandry, in three years, amounts to	157942

This is an object of great importance, not only to the public, whose welfare it highly concerns, but to every owner of land. How strongly does it shew the vast advantage of the drill husbandry! We here see 150 arpents of land produce 157942 pounds of wheat more

more than they would have done without this favourable culture.

Any one may easily reckon the value of such a quantity of wheat, supposing it to be of the very best sort, as in fact it was.*

EXPERIMENT, No. XVIII.

I Shall now give a short account of the success of another farm, which I have hitherto sowed in equally distant rows, with the drill-plough. I generally sow about 18 or 20 arpents of it every year. For the crop of 1755, I used 1840 pounds of seed corn, which produced 10400 pound weight of grain. For the crop of 1756, I sowed 2772 pounds of wheat, the produce of which was 14560 pounds, which is a great deal, considering the quality of the land.

I shall conclude this article with a short detail of two little experiments made by the person I last spoke of, on two fields of different soils. The first, which contained an arpent and an half, was a light soil, and somewhat stony. The quantity of seed generally used for that ground, was about 380 pound weight. It was sowed very thick, with the drill-plough, and took up 252 pounds of seed. I attended carefully to the progress of this corn. It ripen'd well, the straw was very long, and crowned with fine ears which yielded 2835 pounds of grain.

The second experiment was made on a stiff soil. Half the field was sown in the common way; and the other half in equally distant rows with the drill-plough, and only two-thirds of the usual quantity of seed was used. This last half yielded double what the other did, though it was sown with a third less seed.

ARICLE III.

THE design of this article is, to shew that lands which are laid out in beds according to the new husbandry, produce more corn than those which are only sown in equally distant rows, with the drill-plough. The proof of this proposition will result from proper calculations, and a comparison of the products of these two different methods.

It

* Reckoning the English bushel at 62 pounds, these 157942 pounds will exceed 320 quarters of wheat.

It is of no ſmall importance to the public, to know exactly which is the beſt and moſt profitable way to cultivate land. This article deſerves ſtill more attention than the laſt, as it tends to point out the means that are in reality moſt advantageous, tho' oppoſed by an obſtinate attachment to the old huſbandry, and the extreme reluctance with which farmers can ever be induced to try a new practice, which they are almoſt always ready to condemn without taking the pains to know what it is, and indeed, generally, becauſe they are not able to judge of it. It cannot therefore be expected, that the theory alone ſhould ſatisfy them that this huſbandry is conſiſtent with the beſt principles of agriculture. If any thing can convince them, it will be a ſeries of facts, and experiments repeated during a courſe of years, always ſucceſsfully in ſo many different places.

It is highly eſſential to dwell upon the proofs that the old huſbandry is leſs profitable than the new, in which the field intended to be ſown is firſt laid out in beds: for, after ſhewing that lands ſo laid out and ſown, produce conſiderably more than thoſe which are ſown only in equally diſtant rows, with the drill-plough, as has been demonſtrated in the foregoing article; and likewiſe, that theſe laſt produce conſiderably more than they uſed to do in the old huſbandry; the ſuperiority of the crops which the beds afford, will certainly appear ſtill more ſtriking, and no doubt will remain of the excellence of the new culture.

To this end, we ſhall compare the neat produce of the three farms mentioned in the foregoing article, this year 1756, with that of the fields which I have laid out in beds.

In conſequence of the general opinion, that dung, or any other kind of manure contributes greatly to fertilize land, and makes it produce more than it would otherwiſe, it is to be obſerved in the firſt place, that part of the land of the three farms was dunged, and that my fields, cultivated in beds, had not had any dung or other manure for many years.

Secondly, that the lands of the three farms are always fallowed every ſecond year; whereas my fields have been ſown every year ſince they firſt began to be cultivated in the new way, and have already borne ſeveral crops running.

Thirdly, it ſhould be conſidered, that the year 1756 was extremely rainy: a circumſtance by no means favourable to ſtrong ſtiff ſoils, like mine; and at the ſame time rather beneficial than

hurtful.

hurtful to the three farms, a great part of which is light land, which requires frequent rain.

Laſtly, the reader will remember, that about a third part of the ſecond farm was overflowed, whereby the crop was diminiſhed: but on the other hand, I think this damage is pretty nearly compenſated by the accidents which happened to my field, (experiment No. IV.) which certainly leſſened the crop conſiderably.

Theſe reflections ſeemed to me neceſſary, in order to give a juſt idea of the compariſon I am going to make, which, I believe, will be ſufficient to prove what I purpoſed to ſhew.

Compariſon of the produce of land ſown in equally diſtant rows with the drill-plough, with that of other land laid out in beds.

The neat produce of the three farms, containing about 150 arpents, which were ſown in equally diſtant rows with the drill-plough, was, after deducting the ſeed,

		Pounds.
Of the	Firſt Farm	69732
	Second Farm	15456
	Third Farm	26550
	Total neat produce . . .	111738

Neat produce, after deducting the ſeed, of the fields laid out in beds, and ſown with the drill-plough; with the number of each experiment, and the meaſure of each field.

			Pounds.
Experiment, No. 2.	.	1 arpent . .	1834
4.	.	12 . . .	2824
5.	.	5 . . .	2156
6.	.	2 . . .	627
7.	.	12 . . .	5750
8.	.	1 . . .	1850
9.	.	5 . . .	1924
10.	.	5 . . .	2352
		In all 43 arpents.	
Total neat produce in 1756		. . . .	19317

After

	Pounds.
Brought over; Total neat produce in 1756 . . .	19317
After the beds are once formed, the same fields are sown every year: consequently these will produce another crop in 1757, which, supposing it to be only equal to the last, tho' there is great reason to think it will be much better, will again be	19317
Forty-three arpents will then produce neat, in two years, ...	38634

The 150 arpents of the three farms sown in equally distant rows with the drill-plough, will produce nothing in 1757, that being their year of fallow; consequently their neat produce in two years, will have been only 111738 pounds of wheat, whilst the 43 arpents made into beds, will have produced 38634 pounds. But supposing the 150 arpents to have been cultivated in beds, and their produce to have been in the same proportion as that of the 43 arpents, it would amount to 134769 pounds, which is 23031 pounds more than they produced when sown in equally distant rows with the drill. This difference ought never to be forgot.

The new method of laying the land out in beds, has still greater advantages than this. Our comparison has been only of the neat produce of 150 arpents which were sown the same year in the three farms: but it is to be observed, that these farms consisted of 150 arpents more, which were under fallow for the next year's crop. The neat produce of the crops of those 300 arpents in the two years of sowing them in equally distant rows with the drill-plough, supposing both crops to be equal, would be

	Pounds.
For the first year, 150 arpents, . . .	111738
For the second year, for the 150 other arpents, .	111738
For the two years	223476

If these 300 arpents were laid out in beds, they would be sown

 each

each year, and their neat produce, ſuppoſing both years alike, would be,

	Pounds.
For the firſt year, 300 arpents	134769
For the ſecond year, 300 arpents . . .	134769
For the two years	269538

So that this calculation proves plainly, that the 300 arpents will produce 46062 pounds of wheat more when cultivated in beds, than when ſown in equally diſtant rows with the drill-plough: a difference which, in ten years, will amount to 230310 pounds of grain.

As great as this advantage is in favour of the beds, it will appear very ſmall when compared to that which the culture in beds has over the old huſbandry; as the following calculation will ſhew.

Let us firſt ſettle what would have been the neat produce (by which we always mean that which remains after deducting the ſeed) of the 150 arpents of the three farms, for one year; and afterwards that of the other 150 arpents the next year, ſuppoſing both crops to be equal.

We have already ſeen that the produce of 150 arpents would, at moſt, not have exceeded 55200 pounds of wheat, in 1756. But as that was a bad year, I will make the following compariſon on the footing of a good crop, in order to give the old huſbandry every advantage that can poſſibly be deſired. I will therefore ſuppoſe the neat produce of 150 arpents to have been the firſt year . . . . 76000 lb.
and that of the other 150 arpents, the next year, . 76000 lb.

For the two years . . . 152000 lb.

We have ſeen that the ſame 300 arpents cultivated in beds, reckoning their neat produce for two years only on the footing of the bad crop of 1756, would have yielded 269538 pounds of wheat: conſequently this culture would have produced in two years 117538 pounds of corn more than the old huſbandry; and this difference, in ten years, would amount to 587690 pounds.

The

The great advantage of the new huſbandry, in general, and that of laying the ground into beds, in particular, is, I think, now fully proved. The difference is great indeed: but I believe it will be ſtill much greater hereafter, when the yearly obſervations of the followers of this new way, whoſe number increaſes daily, ſhall have brought this culture to a greater degree of perfection, which I hope will in ſome meaſure be the caſe next harveſt.

CHAP. III.

Of the Culture of MAIZ *or* INDIAN CORN, *by* M. AIMEN, M.D. *at Bourdeaux.*

THE land which is intended to be planted with maiz, ought to receive two good plowings in March. It is proper to obſerve that this plant thrives better in a light and ſandy ſoil, than in a ſtiff and clayey one; and that it cannot do without dung.

Towards the end of April, the furrows are made by giving the ground a third plowing; after which the clods are broken by hand, becauſe the furrows prevent uſing a harrow.

A fair day is choſen in May, to ſow the maiz, which is done by making ſmall holes with a ſtick or other inſtrument, at the bottom of the furrows, into which two grains of maiz are dropt.

Care is taken to make the furrows, or trenches, a foot and an half aſunder, and the holes in thoſe furrows at the ſame diſtance from each other, in ſuch manner that they form a kind of quincunx.

When the maiz is come up, the weakeſt of the two plants is plucked up wherever both grains have ſprung, and two new grains are planted where neither of them have grown.

Towards the 15th of June, the earth is hand-hoed round each plant; and as they ſtand in the bottom of a furrow, the mould which crumbles down from time to time, lays freſh earth to their roots, and helps to ſupport them.

Towards the end of July, a ſlight hoeing is given them, which is the laſt; and in ſo doing the earth is laid towards the roots of the plants.

The 15th of Auguſt, the panicles of the male flowers are cut off. It is well known that theſe contain no grain, and that they grow at the top of each plant. Care muſt be taken that the grain be impregnated before they are cut off; which may be known by the outward covering of the ears appearing turgid. The panicles muſt not be cut off from all the plants at the ſame time, becauſe ſome of the ears are a fortnight later than others, before they are impregnated. Theſe panicles are excellent fodder for cattle.

Nearly about the ſame time, all the leaves are ſtripp'd off the ſtalks, together with all the blighted and ſmutty ears: for it is pretended that if they ſhould be left upon the ſtalks, the good ears would not grow ſo big, nor the grains be ſo well nouriſhed.

All theſe leaves and ears are given as fodder to oxen; and what is remarkable is, that thoſe creatures are fonder of the ſmutty ears, than of all the reſt.

The time for reaping maïz is towards the end of September: the ears are then gathered by hand, and put into baſkets, in which they are carried and laid in heaps from ſpace to ſpace in the field; after which they are loaded in carts, carried home, and ſpread upon an even floor prepared for that purpoſe. They are then taken out of their ſheath or hood, and dried in the ſun before they are laid up in the granary; or elſe the grain is taken out at that time.

There are two ways of taking out the grain. The firſt is, by threſhing it with a flail: this method is the moſt expeditious; but it breaks and bruiſes much of the corn. The ſecond, which is moſt uſed, is, by rubbing the ears hard againſt the edge of a flat piece of iron: this eaſily ſeparates the grains from the ſtalk, without hurting them. Theſe ſtalks are good food for oxen.

As ſoon as the ears are gathered, the ſtalks remaining in the ground are plucked up, and laid by for winter fodder for oxen. The field is afterwards plowed up as ſoon as poſſible: it being the general opinion of farmers that the roots of the maiz would otherwiſe continue to ſuck up the rich particles of the earth. Whether this be true or not, their notion is, that if this plowing ſhould be deferred, the next year's crop would certainly ſuffer by it.

When the maiz has been well dried in the ſun, it will keep ſeveral years; and not be the leſs fit for ſowing. It keeps better in grain, than in the ear.

It has been obſerved, that the weevil is much more apt to attack the grains of maiz while they are left in the ear, than when they are ſeparated from it. Perhaps the ſweet juice of the ſtalk may attract them, more than the grain itſelf.

Laſtly, the grain is laid up in a dry granary, and care is taken to turn

turn it every three months; which prevents its growing musty, or being attacked by insects.

In many places, the country people mix a certain quantity of this corn with the wheat or rye of which they make their bread. Far from hurting, it gives it a favoury taste. The general proportion is, an eighth part, and sometimes more, of this corn, to seven parts of wheat.

Bread made of the flour of maiz alone, is yellow: and it is heavy and hard to be digested, because the dough ferments very little, if at all. However, many of the peasants in Guyenne fed upon it for whole years without finding any inconvenience from it; particularly in 1738, when all the corn of that province was destroyed by hail; and in 1748, during the great scarcity of corn. They likewise made a kind of hasty-pudding with the flour of maiz, which is well tasted enough, but hard to digest.

Maiz is also of great use to fatten poultry and hogs. It is given whole to the larger kind of fowls, and broken a little to others.

When maiz is planted for fodder, particularly of cows and oxen, it is in a good soil, which is plowed twice, and well dunged; after which the grain is sowed and harrowed in, or covered with a rake.

Maiz is a great impoverisher of land: for though the ground be dunged every time it is planted with this grain, it has been observed that wheat never does so well in the furrows where maiz has grown, as in the neighbouring fields where it never was.

M. Aimen has observed, 1. That it is important to sow Maiz, rather in the beginning, than at the end of May; because, if it is sowed early, the plants will have acquired sufficient strength before the great heats, to shoot out then with vigour: and their ears will not be parched, or liable to that barrenness to which maiz sowed too late is subject: and not only their stalks will be stronger, but their ears will be bigger and fuller of grain: 2. That the ears of the maiz are greatly hurt by cutting the panicles too late; and that they ought to be cut before the hoods open. By leaving a plant with its male ears at every twenty feet distance, all the female plants will be impregnated.

For two years together, M. Aimen singled out two rows of maiz, the plants of which seemed to him equally strong. He cut off the panicles of the male flowers of all the plants in the first row, before their hoods opened: the panicles of the other row were not cut off till the usual time of performing that operation: the consequence was, that the female ears of the first row were much the largest and best filled with grain.

M. Aimen sowed a row of maiz at a distance from any other field planted with that corn. He cut off the panicles of that row, before the hoods were opened, leaving only one plant with its male flowers at every twenty feet distance. At harvest, he observed, 1. That all the female ears of all the plants were impregnated: 2. That the female ears of the plants which had lost their male panicles early, were thicker, longer, and fuller of corn, than any others: 3. That the female ears of the plants whose panicles had been cut late, were smaller and shorter, and that in some parts of them the grains were abortive.

It would be right to try the culture of maiz with the cultivator, of which we shall give a description hereafter. To that end, it would be proper to plant the rows two feet asunder, and the grains in those rows twelve or fourteen inches distant from one another. All the necessary hoeings might then be given with the cultivator drawn by one horse. I believe the maiz would thrive the better for it, and that the land would afterwards be fitter for other grain. It is worth the while of those who live in countries where maiz is cultivated, to try what this will do.

Great quantities of maiz and millet are raised in Guyenne. What M. Aimen says of the culture of this last plant, we shall defer mentioning, till we come to treat expressly of it in the next part of this work, and continue here his observations upon maiz.

Custom, says he, has taught our farmers to keep their plants of maiz about a foot and a half distant from each other if they would have a good crop. In order to know whether it was absolutely necessary to leave so great a distance, he made the following experiments.

In April 1753, he prepared six beds like those of the former experiments. Three of them, which we shall speak of hereafter, were sown with millet, the 1st of May. The other three were sown with maiz, the third of that month. The first was sowed after the usual manner of the country, with one ounce and one pennyweight of seed: the second was sowed with two ounces and two pennyweights, the grains being only a foot asunder: and a third, in which they were but six inches apart, was sowed with four ounces and a half.

The

The firſt of theſe beds produced 18 pounds and four ounces: the ſecond, 15 pounds 7 ounces; and the third 11 pounds two ounces.

Maiz is ſometimes ſowed very thick, when it is intended only for fodder. In that caſe, all the female flowers are barren, and produce no grain.

This experiment, ſays M. Duhamel, proves that ſome kinds of grain will not do well, unleſs they are ſown very thin. I am perſuaded, added he, that for want of this precaution, a great deal of grain is often loſt, and the crops are conſiderably diminiſhed.

We are favoured with the following account of the culture of maiz in North America, by a very worthy and ingenious gentleman of that country.

" The Engliſh in North-America, plough the ground thoroughly " before the grain is planted. They ſeldom, if ever, dung the whole " face of the field, but ſometimes put a little dung in each hill of " corn, if they think the ground requires it. Where fiſh are plenty, " in the planting ſeaſon, they put two or three ſmall fiſh into each " hill, with the grain.

" In order to plant the corn, they make trenches or furrows, " with the plough, acroſs the field, at certain diſtances from each " other, and croſs theſe with others of the ſame diſtance, which " divide the field into ſquares; and where the trenches interſect, the " grain is put in, and covered. Three or four grains are commonly " planted for each hill. The intermediate ground is afterwards " plowed at leiſure, as the plants grow, and want more looſe earth " for the roots to ſpread in. The hills are made at the time of " weeding, ſome looſe earth being then hoed up over the roots, " and round the ſtems or ſtalks of the corn.

" The corn is planted at different diſtances in different places. " In the northern colonies, the Indian corn grows low, ſeldom ex- " ceeding four or five feet in height; and the leaves being propor- " tionably ſmall, the plants do not require ſo much ground as in the " ſouthern colonies, where they frequently riſe to fourteen or fifteen " feet. The ſpace generally allowed for the loweſt plants, is three " feet, and for the higheſt, five or ſix. This diſtance may be more " neceſſary in our manner of cultivating this corn; more ground be- " ing required to nouriſh three or four plants, than one; for I do " not know that we ever pluck up any of the plants. An advantage " attending this method is, that the labour is leſs in hilling; three

" or four plants being earthed up in the ſame time as one: and there " is more room for paſſing between the rows when the corn is to be " weeded.

" At the ſame time that the corn is weeded, the ground is looſened " round the plants, with a hoe, and the hills are raiſed and enlarged " from time to time, by adding more earth. The morning, before " the dew is off, and the evening, are reckoned better for this work, " than the middle of the day.

" The hilling of the corn, as it grows, has been the univerſal " practice: the deſign being to give the plant more nouriſhment, " and to ſupport it better againſt the winds: but of late, ſome " planters have thought it better to plant in holes: the reaſon is, that " this plant requires a good deal of moiſture: and indeed, nature, " by the form and poſition of the leaf, appears to have intended " the receiving of the rain that falls around, and conducting it to the " ſtalk, and by that, down to the roots: but a hill round the ſtalk, " tends to throw the water off to a greater diſtance: and as to ſup-" porting the plants, they ſay the hills do not effect it; becauſe, by " covering the ſtalks, in that part, from the air and ſun, which would " harden and ſtrengthen them, the mould around them keeps them " ſoft and tender, and thereby rather weakens them*.

" The panicles, or toſſils, contain the *farina fæcundans* of the " plant, and therefore ſhould not be cut off, till the grain in the ear " is filled. If the toſſils of a whole field ſhould be cut off before that " time, there would be no grain at all in the ears. This has been " proved by experiment.

" In the more ſouthern colonies, where hay is ſcarce, and the " leaves of this corn are very large, they cut them off for fodder: " but in the northern colonies, where there is plenty of hay, and " the leaves of the corn are ſmall, they generally neglect cutting off " the toſſils, and ſtripping off the leaves. They are left on the ſtalks, " and the cattle, being turned into the fields, after tne corn is

* It muſt be of great advantage to ſtrong quick growing plants, like Indian corn, to have a looſe deep mould to grow in. We therefore think that the new huſbandry muſt be ſingularly uſeful in the culture of it: for ſtirring the ground with the cultivators or horſe-hoes, will keep it in a looſe ſtate; and M. de Chateau-vieux's cultivator with mould boards, is very well adapted to raiſe the earth into hills about the plants, as it goes acroſs the field, in the manner they hoe the ground in their uſual way: and as this cultivator leaves a large furrow in the middle between each hill, the farmer will thereby have an opportunity of looſening the earth to a great depth.

" gathered in, eat what they like of them: but they are not eſteemed
" ſo good as what has been cut in ſeaſon.

" An eaſy way of taking the grain out of the ears, is, to rub one
" againſt another, holding one in each hand.

" When the ears are ſtript of their huſks, they are reckoned in the
" beſt ſtate for preſervation; much better than when the grain is
" rubbed off from the ear: for then, they ſay, inſects can get at the
" ſoft part of the grain; and eat into it; which they cannot do,
" while the ſoft part is connected with the cob in the ear, and the
" hard flinty part of every grain turned outward, and the grains
" cloſe to each other.

" To preſerve their corn, they make, in North-America, a ſort
" of bins, or cages, which they call corn-cribs, fifteen or ſixteen
" feet long, and five or ſix feet wide, widening upwards to the top
" a foot or more. They are made of ſapling poles, three or four
" inches diameter, framed roughly together, by notching the ends
" where they croſs the corners, at ſuch a diſtance from each other,
" as but juſt to keep the ears from falling through, that there may
" be a free paſſage for the air. Theſe bins ſtand abroad, and
" have a ſlight moveable covering, or thatch, to keep out the rain.
" The Indians bury their corn in holes in the ground, lined with
" mats and dry leaves.

" The manner of uſing this corn in America, is various. It has
" this advantage over wheat, that ſubſiſtence may be drawn from your
" corn fields long before the general harveſt: for the green ears
" roaſted, are delicate food; and as the corn ripens and grows harder,
" the ears boil'd are good eating, with butter and ſalt. When it is
" ripe, the corn parch'd and ground into meal, is the hunting and
" war proviſion of the Indians; being light to carry, and affording
" good nouriſhment. They mix a little of it with water, and it
" needs no other cooking, having already paſs'd the fire in the parch-
" ing. The grain ſoaked in water, will part with its ſkin when beat
" in a large mortar with a wooden peſtle: then it is boiled and eaten
" with milk. Being pounded coarſely, dry, it is alſo boil'd and
" eaten as rice. Bag puddings, and bak'd puddings made of it pro-
" perly, are very good. The meal is alſo boil'd with water, to
" make what they call a haſty pudding, which they eat with butter
" and ſugar, or with milk. This haſty pudding, or boil'd meal,
" being mix'd with twice as much dry wheat flour, and worked into
" loaves, makes much better and pleaſanter bread than flour alone.

"All creatures fed with Indian corn, have firm fat and flesh: the "pork of corn-fed hogs is reckoned the finest in the world for taste "and goodness; their fat, milk-white, and as hard as butter. The "horses of Virginia and Maryland, whose chief fodder is the leaves "and stalks of this corn, are reckoned the hardiest of the species, "bearing most labour, and requiring least care. The people, in the "countries where most of it is eaten, are healthy, strong, and hardy, "and generally well grown and well looking; except only where, "from the neighbourhood of marshes or stagnant waters, the air "they breathe is unwholsome.

"If planting of Indian corn is try'd in England, the seed should "be obtained from the most northern of our colonies. The southern "corn would scarcely ripen here."

CHAP. IV.

Experiments on Smyrna wheat.

SMyrna wheat has a very large ear, with several less, or collateral ears, growing out of, or round this large one. It requires a great deal more nourishment than the common husbandry will afford; for there its ears grow very little bigger, and produce little, if any, more grain than those of common wheat†. In all probability, it will do much better when cultivated according to the new method: but the experiments which have hitherto come to our knowledge are very few. The following is the chief, and indeed the only one worth mentioning.

M. Le Vayer, master of requests, sowed some of this wheat in 1751, in a small part of his estate at Duviere, in the province of Maine, and had a very good crop. He sowed it again in 1752, in the common way; and though it did not answer near so well this time, it yielded him a third more than common wheat would have done.

In order to try how this wheat can be cultivated to the best advantage, M. Le Vayer sowed seven pounds and an half of it, in November 1752, in two pieces of ground which had formerly been a kitchen garden, and of which the soil was good and deep. It came up well,

† Count de la Galissoniere, says M. Duhamel, sowed some of it for several years: it produced a little more grain than common wheat; but the bread which was made of it, was not so good.

and

and the plants were very fine till July, when heavy rains fell, which laid them quite flat. The great heats which came on immediately after, raiſed them but very imperfectly. However, notwithſtanding all this, the grain filled and ripened perfectly: but, tho' the year was very forward and extremely hot, this corn could not be reaped till near three weeks after the common wheat. It produced thirty one ſheaves, which yielded ſeven buſhels of 60 pounds, that is to ſay, 420 pounds in all; which is 56 for one. If this ground had been ſown according to the common method of the country, it would have taken up fifty pound weight of ſeed; and, good as the ſoil was, its produce would not have been more, even in the beſt of years, according to the general run of the crops of this country.

" The reſult of this experiment," ſays M. le Vayer, " ſeems to " contradict the theory of the new huſbandry, which promiſes that the " ſtalks of wheat cultivated in the new way, being leſs crowded, and " more expoſed to the air, will be ſtronger and leſs apt to be lodged, " than that which is ſowed in the common way. It is likewiſe to " be obſerved that the common wheat, ſowed according to the old " method, was not lodged at all this year, but kept quite upright, " tho' it ſuſtained the ſame rain as the other. The bigneſs of the " ears of the Smyrna wheat, which makes them the more apt to re- " tain wet, may have occaſioned this difference. However, M. du " Verger, who, the ſame autumn, and laſt ſpring, ſowed common " wheat, ſpring corn, and barley, in rows, found that neither of " theſe grains ripened till long after thoſe of the ſame ſpecies ſown " in the common way, and that all of them were lodged. That ex- " cepted, his crop was good. But if the ſame accident ſhould happen " every year, it might be feared that the grain would not be able to " ripen thoroughly, and eſpecially in cold wet years. This is, per- " haps, an inconvenience in the new huſbandry, to which cold " countries may be more ſubject, than thoſe that are warmer."

This, as M. Duhamel obſerves, cannot be known, but by a ſeries of experiments: for, adds he, we ſee that the corn ſown in the new way, has been reaped, in many places, almoſt as early as any other, when care has been taken to ſow it ſooner. It has been prevented from lodging, by turning the earth of the alleys over towards the rows.

M. du Verger, who lives at Mans, having communicated his experiments to me, I muſt obſerve, that they were made on very ſmall ſpots of ground, from which, as I have ſaid before, no concluſion can be drawn, becaufe the borders of a field are almoft as favourably fituated as the beds of the new hufbandry, the roots of the plants there being able to extend themfelves to feek their food: this is the reafon why the plants near the foot paths in corn fields are always the fineft: now it is very plain that the outfide borders of a very fmall fpot of ground are a confiderable part, in comparifon of the whole; and therefore its produce cannot juftly be compared with that of another fmall fpot fowed in rows.

CHAP. V.

Experiments made on wheat of different countries.

IT would be wrong to fufpect us of having no other view, than merely to extol the new hufbandry. The only reafon that induces us to dwell fo much upon it, is, that we think it may be extremely profitable in fome cafes, and very ufeful in others. Whatever is capable of promoting the progrefs of agriculture, is equally interefting to us. With this view, we applied to the factors of our Eaft-India company for famples of the different kinds of wheat of the countries where they refide. They were fent to M. de Reaumur, who was fo kind as to deliver them to me. I fhall fay, in a moment, what ufe I made of them. The late marquis de la Galiffoniere had before given me a pretty large quantity of a wheat which he had brought from Spain, and which he knew made the beft bread of any in Europe. At the fame time, the marquis de Gouvernet gave me a fample of a large grain'd fpring wheat, which was faid to multiply exceedingly.

I was the more pleafed with having thefe famples, as I am perfuaded that many of the different kinds of wheat which are generally cultivated in moft countries, may, by reafon of the foil or other phyfical caufes, not be fo fit as fome other kinds might be, to produce the moft plentiful crops, or to make the fineft bread. Few counties or indeed few countries, cultivate more than two or three kinds of wheat; and the generality of farmers have fo little curiofity, that they do not fo much as think of trying whether any of the forts that are cultivated in other countries, would not be preferable to thofe they ufe.

An attentive traveller may obferve that the wheat which grows in the different countries he goes through, is not all alike: but he contents himfelf with making this obfervation in general, without confidering ſidering that he would do his own country, or his own county, an eſſential ſervice, by bringing into it a better kind of wheat. 'Tis true, this might perhaps be attended with ſome little trouble: to avoid which, moſt people are very ready to perſuade themſelves that thoſe more perfect kinds of wheat would not anſwer in another ſoil than their own, or that they would ſoon degenerate in it. For my part, I am thoroughly ſatisfied, that improvements of this kind, ought by no means to be looked upon as objects of ſmall importance, and that it is right to try the culture of different kinds of grain, in hopes of meeting with ſome which may deſerve the preference to that which it is the cuſtom to ſow. Doubtleſs, many might not ſucceed. Accordingly, I was not at all ſurpriſed at the poor condition to which the wheat I received from Suratte and Bengal, and which I ſowed in autumn and in the ſpring, was reduced. Thoſe climates are ſo different from ours, that I could not well expect any better ſucceſs.

The Spaniſh wheat, which M. de la Galiſſoniere gave me, and which I ſowed in autumn, roſe well; and the winter, being very mild, it made a fine appearance till near whitſuntide: but then, it dwindled away on a ſudden, and afforded ſcarce any crop at harveſt. The caſe was different with ſome of the ſame wheat which I ſowed in March. Notwithſtanding the too frequent rains, which hurt every other kind of wheat, this was equal to the very fineſt corn, and yielded an excellent grain, as hard, and tranſparent, as if it had grown in Spain. The whole produce of this crop is ſet apart, to be ſowed next ſpring. This ſame corn was tried, with exactly the ſame ſucceſs, at Digny, and at Denainvilliers.

The ſpring wheat which I had from M. de Gouvernet, ſuffered more from the intemperature of the ſeaſons, than the Spaniſh wheat. Its grain was ſhrivelled. However, I keep it for next year.

I ſent ſome of each of theſe kinds of wheat to M. le Vayer, who ſowed them, and after harveſt wrote to me as follows.

" A pound and an half of Spaniſh wheat (the marquis de la Ga-
" liſſoniere's) ſowed in autumn, produced five pounds and an half
" of clean grain. This wheat was as fine as that we are going to
" ſpeak of. The ſcantineſs of the crop was owing to the birds that
" preyed upon it.

" The ſame quantity of the ſame wheat, ſowed in the ſpring, pro-
" duced ſixteen pounds of very clean grain.

" Half an ounce of large grain'd ſpring wheat (the marquis de
Gouver-

" Gouvernet's) ſowed the 11th of October, produced only two " ounces and an half of bad grain.

" Another half ounce ſowed in the ſpring, roſe well; but not be- " ing able to bear the almoſt continual rains, it produced nothing.

" Two ounces of Suratte wheat ſowed in October, produced but " three pennyweights of a very light and meagre grain.

" Two ounces of the ſame wheat ſowed in March, roſe well, but " bore no ears.

" Two ounces of Bengal wheat ſowed in October, produced " twenty ounces of pretty fine grain.

" Two ounces of the ſame wheat ſowed in March, produced but " three ounces."

It is to be obſerved, that the ſoil in which theſe different grains were ſown, though good, is clayey. M. le Vayer choſe it on purpoſe; not only becauſe it was new ground, but likewiſe becauſe its expoſition was due South, and it was ſheltered on the north ſide by a high wall. All this ſeemed very proper for a grain which came from ſo very hot a country: and perhaps it might be owing to this precaution that the Bengal wheat ſucceeded better with M. le Vayer, than at Denainvilliers.

The Suratte wheat, which is reaped in the iſle of Bourbon four months after it is ſowed, did not ripen with M. le Vayer till eight or ten days before the common wheat, tho' it was ſowed in autumn. It is not to be doubted, but that if the ſummer had been warm and dry, theſe grains would have ſucceeded better, and eſpecially that which was ſowed in the ſpring; and probably that which was ſowed in autumn, would have periſhed in the winter, if that ſeaſon had not been extremely mild.

A PRAC-

A PRACTICAL TREATISE OF HUSBANDRY.

PART III.

Of the Culture of SPRING CORN, MILLET *and* RICE, LEGUMINOUS PLANTS *and* POT-HERBS, FLAX *and* HEMP, ARTIFICIAL *and* NATURAL GRASS, *and the* VINE.

CHAP. I.

Experiments on BARLEY, OATS, *and* RYE.

SECT. I.

Experiments made near Bourdeaux, *by* M. Navarre, *Dean of the Court of Aids.*

THE thirteenth of December, 1751, M. Navarre ſowed four beds, two with wheat, one with rye, and the fourth with barley. The beds were 24 feet long, and, with the alleys, 6 feet wide. The grains were ſown at the diſtance of eight inches from one another; and each bed had three rows, which were likewiſe eight inches aſunder.

The wheat appeared long before the rye and barley, and ſuffered greatly by inſects, which not only eat numbers of ſhoots two or

three

three inches long, close to the ground, every day, but also attacked the roots and the grain in the earth. Disgusted by this incident, he gave up this spot, concluding it would come to nothing. The rye and barley came up much later.

However, he was surprised afterwards to find several plants of wheat, some of which had upwards of 60 stalks, with long ears. The rye and barley were less damaged. The rye had, in general, from 50 to 55 tall well ear'd stalks; and one of the plants of barley had 101 stalks.

What he particularly remarked was, that in all these beds, the middle row branched least and was much the weakest: whence he concluded, that it would be best to make the beds only four feet wide, and to sow but two rows in them, and those a foot asunder; an alley of three feet being sufficient to admit the summer plowings with one bullock.

M. Diancourt sowed eight perches of ground with oats, in double rows, with alleys six feet wide. Farmers, the most prejudiced against the new husbandry, acknowledged that there was more grain in one of those double rows, than on eight perches sowed in the common way.

SECT. II.

Experiments made at Avignac in Britany, by M. DE BRUE.

M. De Brue sowed, with winter oats, part of a field which had been rested, but brought to a fine tilth, and was of a light soil. The severity of the cold having destroyed the oats, he plowed it up again in March, for spring oats, which were very fine. Most of the stalks were five feet high.

He left untouched a small corner, where he perceived several plants of the winter oats, which the frost had not destroyed. Though this spot had been exposed to the trampling of cattle, and promised but little from the beginning, M. de Brue was surprised at the beauty of these oats, and at the quantity they yielded. The straw was six feet high, and loaded with very fine grain. " It is true, says he, I " believe I was partly indebted for this success to the dryness of the " season: for the ground I am speaking of, is frequently overflowed " in wet years, notwithstanding all the pains I have taken to drain " it.

" In the month of August," continues this gentleman, " I plow-" ed

"ed up another field which had juſt borne hemp, and made it into
"beds, 10 or 12 feet wide. In the beginning of September, I
"ſowed it with about 120 pounds of rye, which came up very
"thick. I mowed it three times, before it ſpindled, and got fifteen
"thouſand weight of green fodder, which was of great ſervice to
"my cattle, the ſeverity of the winter having left very little graſs
"on any paſture grounds.

"This fodder purges and nouriſhes cattle. The cows that were
"fed with it gave plenty of milk, which made excellent butter.
"Many farmers, who ſaw what I did, intend to follow my example.
"I let the fourth ſhoots of this rye grow up to feed. The ears
"were very ſmall, and yielded me nearly the quantity I had
"ſown.

Mr. Miller mentions the practice of ſowing rye for fodder, in ſome parts of England. "Rye, ſays he, is ſown in autumn, to
"afford green feed for ews and lambs in the ſpring, before there is
"plenty of graſs. When this is intended, the rye ſhould be ſown
"early in autumn, that it may have ſtrength to furniſh early feed.
"The great uſe of this is to ſupply the want of turneps in thoſe
"places where they have failed, as alſo, after the turneps are over,
"and before the graſs is grown enough to ſupply green feed for the
"ewes; ſo that in thoſe ſeaſons, when the turneps in general fail,
"it is very good huſbandry to ſow the land with rye, eſpecially
"where there are ſtocks of ſheep, which cannot be well ſupported,
"where green feed is wanting early in the ſpring."

SECT. III.

Extract of a letter from a gentleman in Poitou.

"BEING perſuaded of the advantages of the new method of
"cultivating land, I reſolved to make a trial of it, by compar-
"ing the produce of a field cultivated in the common way, with
"that of another field cultivated according to the new huſbandry:
"and as M. Duhamel has deſired all lovers of agriculture to try,
"by experiments made with care, whether it be moſt profitable to
"ſow beds, with two, or with three rows of corn; or, which is
"the ſame thing, to find at what diſtance the rows ought to be
"ſown; I divided a ſpot of ground into ten equal parts, which I
"made into as many beds, each ſix feet wide.

" In the middle of five of these beds, I sowed three rows, seven " inches asunder, so that they took up fourteen inches of ground, " and there remained four feet ten inches for the breadth of " the alleys, which is very sufficient for the horse-hoeing hus-" bandry.

" I sowed three other beds with only two rows, a foot di-" stance from each other: consequently the alleys were five feet " wide.

" The two remaining beds were sown with two rows each, three " feet asunder. The alleys were therefore but three feet wide: or " rather, the whole of this last spot may be looked upon as sown in " single rows, with alleys three feet wide, which is too narrow a " space to admit of horse-hoeing them conveniently.

" Before I speak of the products of these beds, it will be proper " to observe:

" 1. That this trial was made with rye. My fear that birds " might eat up the wheat, made me prefer rye; which I advise " every one to do, when only small experiments are made. This " escaped without the least damage: whereas I have observed, that " when experiments have been made with wheat, the birds, pre-" ferring that to any other grain, have always destroyed a consider-" able part of the crop.

" 2. The beds sown with three rows were near a hedge, which " greatly damaged two of them; either by its roots exhausting the " ground, or by its shadow keeping that part harder frozen than " the rest.

" 3. The intervals were not hoed at all, between either the " double or the triple rows: only the alleys were horse-hoed; and " consequently none but the single rows were hoed on both " sides.

" 4. The twenty-fifth of February, the alleys were plowed. I " visited them the second of March; and found, upon examining " the plants, that, in these five days, they had shot out roots four " inches long into the new-stirr'd mould. I repeated the hoeings " at proper times, and the rye continued in good condition 'till it " was reaped. The last hoeing was given after the bloom was " past.

" 5. I then examined the roots, and found they had ex-" tended eighteen inches into the loose mould. This may seem

" strange,

" ſtrange, but I am certain it is true, for I took every precaution " not to be deceived.

" 6. The alleys between the ſingle rows were hoed but twice, " being too narrow to admit the plough after the plants had begun " to branch. However, I had no reaſon to complain of the pro- " duce of theſe ſingle rows.

" Having now given an account of my operations, it is time to " ſay what the products were.

" The ears of my rows were from four to ſeven inches long, and " the ſtalks from four to ſix feet high, which was one third " higher than in the neighbouring fields, cultivated in the old " way.

" This ſpot of ground, in the beſt years, never produced more " than 5 buſhels, including the buſhel of ſeed corn; for that was " the quantity generally uſed: in common years, it has not yielded " above four buſhels, and frequently much leſs. We therefore " cannot reckon its produce, one year with another, at more than " 4 buſhels, including all faulty grains and ſeeds of weeds, which fall " through the ſieve, and remain mixed with the good grain. This " year it has yielded me ſeven buſhels of fine clean rye, conſiderably " larger than the common ſort. I make no account of the ſeed, the " quantity was ſo ſmall. To prevent this grain's being mixed with " any other, and at the ſame time to judge more exactly of the pro- " duce of my ground, I had the ſheaves threſhed out cloſe by the " field: but it was in the middle of a road, where all the grains " ſcattered by the flail could not be gathered up: by which I reckon " I loſt more than the amount of the ſeed that was ſown in the " rows. The produce of my little field was therefore this year, " compared to other years, as ſeven is to four, to which muſt be " added, that it is capable of bearing as great a crop every year, " which is not the caſe in the common huſbandry.

" Let us now examine the produce of the rows, and compare " them one with another, in order to judge whether it be moſt pro- " fitable to ſow in ſingle, double, or triple rows.

" Two beds, the moſt diſtant from the hedge, ſown with triple " rows, yielded three quarters of a buſhel each.

" Two beds with double rows, yielded each two thirds of a " buſhel: conſequently the three beds with double rows yielded two " buſhels, and the ſix rows ſown two and two, in three beds, " yielded one quarter more than the ſix rows ſown three and three "in two beds: but two beds of three rows a piece yielded one-ninth more than two beds of only two rows a-piece: whence we may conclude, that the diſtance of the rows increaſes the produce of an equal number of plants; or, which comes to the ſame, that an equal quantity of ſeed will produce more grain when the rows are more diſtant, than when they are ſown cloſer together. But this is not a real profit, becauſe the ſix double rows take up one-third more ground than the ſix triple rows.

"Each of the ſingle rows yielded ſeven-eights of a buſhel, which is one-ſeventh more than the triple rows, tho' they took up no more ground; and their produce would probably have been greater, if they had been hoed two or three times more.

"It appears by this account, that the profit would probably have been on the ſide of the double rows, if the alleys had been made only four feet wide, inſtead of five: for by this means I ſhould have gained one-fifth more ground, and four feet are a ſufficient width for the operations of the horſe-hoe. Where the ſingle rows are ſo near as in this experiment, the ſame ground would ſcarcely bear another crop the next year, for want of having been ſufficiently ſtirred. To clear up this point by a new experiment, I have ſown ſingle rows in the middle of four beds, two of which are four feet wide, and the two others only three. The winter hoeings have been given them with eaſe, and I hope the others will not be more difficult; at leaſt till all the corn is ſpindled. What I fear moſt is, the earth's being carried off the narrow ſpace on which the rows ſtand, when the thaw comes on, or by the heavy rains which are frequent with us*.

"The reſt of my field is ſowed in two rows, in beds four feet two inches wide. I have done this, becauſe, as it is the general cuſtom here to make our ridges about that breadth, I am in hopes that if I obtain a plentiful crop, I ſhall be able the more eaſily to prevail on the farmers of this country to adopt a method, the advantage of which I was ſenſible of, even before I tried the above experiments."

* Theſe accidents, ſays M. Duhamel, may be prevented, by making the furrow in the middle of the alleys, at a greater diſtance from the rows: the water will then be drained off, without hurting the plants; and in March, the horſe-hoe may be brought almoſt cloſe to the rows, to looſen the mould about the roots, without any fear or danger.

SECT.

SECT. IV.

Experiment on barley, by his Excellency M. BIELINSKI, *grand marſhal of Poland.*

M. Bielinſki gives the following account of this experiment, in a letter to M. Duhamel.

" The 11th of May, I plowed and made into beds, with our " common plough, about ſix hundred ſquare perches of a large " field near the gate of my caſtle. This ſituation gave me an op- " portunity of overſeeing the work myſelf.

" The ſoil is very good, neither too ſtrong nor too light; and " as it was near my ſtables, it had been frequently dunged. It " bore wheat the preceding year, and had been plowed twice after " harveſt. I ſowed it with barley the 12th of May, with the drill- " plough. It took 159 Paris pints, and would have required about " 720, if it had been ſown in the common way: conſequently here " was a ſaving made of near three fourths of the ſeed.

" The firſt of June, the barley ſeeming ſtrong enough, I horſe- " hoed the alleys for the firſt time, with the light plough. The " beds were but four feet wide; deducting from which eight inches, " for the ſpace on which the barley grew, there remained three feet " four inches for the alleys, which I at firſt thought very ſufficient " for all the neceſſary hoeings: but notwithſtanding all the care that " could be taken, ſome parts of the rows were carried off by the " plough, and others were covered with earth. At leaſt one ſixth " of the crop was loſt by this accident. During all June, and part " of July, my barley promiſed well, and branched conſiderably. " Every plant that I examined had from 12 to 20 ears, which were " eaſily diſtinguiſhed from the barley ſown in the common way, by " their largeneſs, and the deep green colour of their blades.

" The ſecond and third hoeings were performed on the 12th of " June and the 15th of July, with the cultivator, which did not " damage the rows ſo much as the light plough had done.

" July was an exceeding hot month. By the 15th, the plants " ſeemed to ſuffer by it, and the extreme ſultry heat of the laſt days " of that month put an entire ſtop to their vegetation. They lan- " guiſhed afterwards, and the lower ſtalks withered before the grain " was well formed. The birds too preyed upon it: ſo that I was " forced to cut it down in the beginning of Auguſt. To complete

" the

"the misfortune, it rained inceſſantly for five days after this corn "was cut, which made many of the ears ſprout in the rick. Notwithſtanding all theſe accidents, my crop yielded 5139 pints of "good clean barley: which is as much as I could have expected in a "middling year, if the field had been ſown in the common way.

"The crop would certainly have been greater, 1. If I had ſown "the barley ſooner; the heat having hurt only the late ſown grain: "and, 2. If the beds had been larger: for then the ſummer culture "might have been given the alleys more conveniently, and without "tearing up or burying any part of the rows."

M. Duhamel, among many other experiments communicated to him by different correſpondents, mentions the following made on oats, in a climate reſembling that of Provence, as an inſtance of the advantage of ſowing thin.

A field, bordering on a meadow was ſown with oats. The owner, before he ſowed it, dug a ſmall ditch of 8 or 10 inches between this field and the meadow, to carry off the water intended for watering the meadow. The earth thrown out of this ditch was laid on the ſide of the field, where it made a little bank 18 or 20 inches wide, on which oats were ſown, as on the reſt of the field, which had been well plowed. Some grains of oats fell all along the ſloping ſide of this bank, next to the ditch, and, in general, at the diſtance of ſix, ſeven, or eight inches from one another. They produced 18, 20, and 25 ſtalks a-piece, taller and ſtronger than thoſe which grew upon the bank, though theſe were much ſuperior to any in the reſt of the field.

To be the more exact in my compariſon, I picked out one of the fineſt ſtalks I could find in each of theſe three places. That which I took from the middle of the field was two feet five inches and one-third long, and had 91 grains of oats on it: that from the top of the bank was three feet nine inches and one-ſixth in length, and bore 165 grains: and that from the ſide of the bank next the ditch was four feet nine inches long, and yielded 214 grains. The ſtraw of this laſt was much ſtronger, and the grain larger and better filled, than any that grew in the field. The difference was ſo great, that I am perſuaded a third fewer of theſe grains would have filled a buſhel, than of the others.

Mr. Miller is ſo ſenſible of the advantage of ſowing thin, that he ſtrongly recommends to farmers, inſtead of four buſhels, which is the common allowance of barley, to an acre, to ſow even leſs than

"half

"half that quantity: "There will, says he, be a much greater produce, "and the corn will be less liable to lodge, as I have many years experienced: for when corn or any other vegetable stands very close, "the stalks are drawn up weak, and so are incapable to resist the "force of winds, or bear up under heavy rains: but when they are "at a proper distance, their stalks will be more than twice the size of "the other, and therefore are seldom laid.——I have seen experiments made by sowing barley in rows a-cross divers parts of the "same field, and the grains sowed thin in the rows, so that the "roots were three or four inches asunder in the rows, and the rows "a foot distance: the intermediate spaces of the same field were at "the same time sown broad-cast in the usual way. The success "was this: the roots which stood thin in the rows, tillered out from "ten or twelve, to upwards of thirty stalks on each root: the stalks "were stronger, the ears longer, and the grains larger than any of those "sown in the common way; and when those parts of the field where "the corn sown in the usual way has been lodged, these parts sowed "thin have supported their upright position, against wind and rain, "though the rows have been made not only lengthways, but cross "the lands, in several positions, so that there could be no alteration "in regard to the goodness of the land, or the situation of the corn: "therefore where such experiments have been frequently made, and "always attended with equal success, there can be no room to doubt "which of the two methods is more eligible, since if the crops were "only supposed to be equal in both, the saving more than half the "corn sown, is a very great advantage, and deserves a national consideration, as such a saving, in scarce times, might be a very great "benefit to the public.

"I know the farmers in general are very apt to complain "if their corn does not come up so thick as to cover the "ground green in a short time, like grass fields: but I have often "observed, that when from the badness of the season it has come "up thin, or by accident has been in part killed, their corn "has been stronger, the ears longer, and the grain plumper; so that "the produce has been much greater than in those years when it has "come up thick: for the natural growth of corn is to send out many "stalks from a root, and not to rise so much in height: therefore "it is entirely owing to the roots standing too near each other, when "the stalks are drawn up tall and weak. I have had eighty-six "stalks upon one root of barley, which were strong, produced

" longer ears, and the grain was better filled than any I ever ſaw " grow in the common method of huſbandry; and the land upon " which this grew was not very rich: but I have frequently obſerved " on the ſides of hot-beds in the kitchen gardens, where barley ſtraw " has been uſed for covering the beds, that ſome of the grains left " in the ears, have dropt out and grown, the roots have produced " from thirty to ſixty ſtalks each, and thoſe have been three or four " times larger than the ſtalks ever arrive at in the common way. " But to this I know it will be objected, that although upon rich " land in a garden, theſe roots of corn may probably have ſo many " ſtalks; yet in poor land they will not have ſuch produce; there- " fore unleſs there is a greater quantity of ſeeds ſown, their crop will " not be worth ſtanding; which is one of the greateſt fallacies that " can be imagined: for to ſuppoſe that poor land can nouriſh more " than twice the number of roots in the ſame ſpace as rich land, is " ſuch an abſurdity, as one could hardly ſuppoſe any perſon of com- " mon underſtanding guilty of: and yet ſo it is; for the general " practice is to allow a greater quantity of ſeed to poor land, than " for richer ground; not conſidering that where the roots ſtand ſo " cloſe, they will deprive each other of nouriſhment, and ſo ſtarve " themſelves; which is always the caſe where the roots ſtand cloſe, " as any perſon may at firſt ſight obſerve in any part of the fields " where the corn happens to ſcatter when they are ſowing it; or in " places, where, by harrowing, the ſeed is drawn in heaps, thoſe " patches will ſtarve, and never grow to a third part of the ſize as " the other parts of the ſame field: and yet, common as this is, it is " little noticed by farmers; otherwiſe they ſurely would not continue " their old cuſtom of ſowing. I have made many experiments for " ſeveral years in the pooreſt land, and have always found that all " crops which are ſown or planted at a greater diſtance than uſual, " have ſucceeded beſt; and I am convinced that if the farmers could " be prevailed on to quit their prejudices, and make trial of this " method of ſowing their corn thin, they would ſoon ſee the advan- " tage of this huſbandry.

" The noblemen and gentlemen in France are very buſy in " ſetting examples of this huſbandry in moſt of their provinces, be- " ing convinced of its great utility, by many trials: and it were to be " wiſhed the ſame was done in England."

CHAP.

CHAP. II.

Of the Culture of Millet.

MILLET requires the ſame kind of ſoil as maiz, *viz.* light and ſandy, and it is prepared after the ſame manner. When the furrows are made, the grain is ſowed very thin, and covered with the plough, or rake. The time of ſowing it is, either between the 15th of May, and the 1ſt of June, or about the 24th of June: this laſt is called midſummer millet.

A month after it has appeared above ground, the earth round the plants is ſtirred with a hand hoe, and at the ſame time they are thinned with the ſame inſtrument wherever they grow too cloſe together. The ſpace of ſix inches is generally left between each plant.

After this operation, the plants are left to themſelves: all that the huſbandman has to do from this time, is, to protect the grain from birds, when it begins to ripen; for otherwiſe they will ſoon devour it.

The millet ſown in May, is cut down between the 15th and 30th of September. that which has not been ſown till the end of June, is not reaped till towards the end of October.

It has always been obſerved, that the midſummer millet has moſt abortive grains; and that its panicles being ſmaller than thoſe of the ſame grain ſown earlier, the crop is likewiſe leſs plentiful: accordingly, farmers ſeldom, or never, ſow it in this laſt ſeaſon, unleſs ſome other plant has taken up their ground till then.

Millet is reaped as follows. The panicles are cut off with a knife near the uppermoſt joint of the ſtalk. Theſe panicles are put into baſkets or ſacks, in which they are carried home, and emptied out in heaps which are covered over with cloths. After the millet has remained in this ſituation five or ſix days, it is ſpread upon the barn floor, and threſhed out with a flail. It is then cleans'd, like other grain.

After the millet is cleans'd, care muſt be taken to dry it well in the ſun, before it is laid up in the granary: for it would ſoon ſpoil if the leaſt moiſture were left in it; this being, of all grains the moſt difficult to keep, unleſs it be thoroughly dry: and on the other hand, none keeps better after it has been well dried: it is not liable to the weevil: it ſhould be turned from time to time in the granary; but if that happes now and the n to be neglected, it ſtill keeps perfectly well.

There are two kinds of millet; *viz.* red and white. The red millet is uſed only for poultry: the white millet, beſides being put to that uſe, is mixed with wheat, and made into bread. It likewiſe makes very good puddings.

In ſome of their poor light lands about Bourdeaux, they ſow another kind of millet, generally known by the name of *ſorgo*, and in that country called *milloco.* It is cultivated in the ſame manner as the former, with this only difference, that the plants of this kind of millet muſt be farther aſunder than thoſe of the other, becauſe their branches grow much higher, and ſpread a great deal wider. This millet is reaped at the ſame time, and in the ſame manner as the white millet. The peaſants near Bourdeaux make bread of this *ſorgo.* It is reddiſh, heavy, ill-taſted, and hard to digeſt. Pigeons and poultry are fond of this grain.

Millet is a great impoveriſher of the earth. For this reaſon, as ſoon as it is reaped, great care is taken to pull up the roots and plow the land immediately. It may be worth while to try to cultivate it, and eſpecially the larger kind, with our cultivator. As this plant requires a great deal of nouriſhment, probably the frequent ſtirring of the earth in the new huſbandry, may be of ſervice to it.

CHAP. III.

Shewing the reſemblance between the culture of rice in China, and the new method which we have propoſed for the culture of wheat.

MY Printer, ſays M. Duhamel, having received from China two books of drawings, in which the culture of rice is repreſented, and the ſubject briefly explained in Chineſe verſes; father Foureau, a jeſuit, who lived ten years in that country, has been ſo kind as to tranſlate them; which enables me to form a clear idea of all the operations relative to that culture.

1. To haſten the ſprouting of the rice, it is put into baſkets, and ſoaked for ſome days in a ſtanding water.

2. When their rice grounds are ſo ſoaked with water as to be quite like mud, they plow them with a buffalo yoked to a plough very ſimple in its make, having but one ſhare, one handle, and no wheels.

3. After a gentle rain, they break the clods with a kind of large hurdle, drawn by a buffalo; the driver ſitting upon it, to increaſe the weight.

The

4. The ground is cleared of all ſtones, and whatever roots are in it are pulled up by a ſtrong harrow, with great iron teeth. This inſtrument is drawn by a buffalo, and a man guides it with the help of two handles, like thoſe of a plough, on which he leans hard. The earth is like mud, and partly covered with water, during all this operation.

5. The earth is afterwards ſmoothed with a harrow, which has ſeveral rows of teeth. A man guides this harrow by its two handles, whilſt a buffalo draws it; and as faſt as its teeth form little channels in the ground, the water runs in, and fills them up.

6. When the rice that was laid to ſoak has ſprouted, the ſeed is known to be good; and it is then ſown by hand, very thick, and as equally as poſſible. Only part of the ground is ſown in this manner, to furniſh plants for the reſt.

The day after it has been ſown, the points of the plants appear above the ſurface of the water: for the ground is overflowed all this time with juſt enough water to cover it.

7. When the plants have acquired a little ſtrength, they are ſprinkled with lime water, to deſtroy the inſects and ſome of the weeds that would hurt them. For this purpoſe a ſmall baſket is faſtened to the end of a long handle, and dipt in the lime water, which runs through it, as it is conveyed over the plants.

The Chineſe have a great veneration for the firſt inventor of this method, which anſwers to our cuſtom of ſteeping wheat in lime-water, or manuring land with quick-lime.

8. Towards April, when the plants are grown ſtrong enough to cover the whole field, and look very green and even, the greateſt part of them is pulled up by handfuls, all the mud is carefully waſhed off their roots, and, being held all this time as even as poſſible with one another, they are planted in tufts, pretty far aſunder, and in a quincunx form, in fields prepared on purpoſe for them. A ſerene day is choſen for this operation, which muſt be performed as quick as poſſible.

This practice of the Chineſe is with reſpect to the common culture of rice, what our new huſbandry is with reſpect to the common culture of wheat.

9. The rice muſt be watered: which is always done in China, by overflowing it. To this end, the rice grounds are always near a

 pond

pond or great pool of water, from which they are feparated only by a bank or caufey.

If the water was higher than the rice ground, a trench cut through the caufey would overflow it at once: but as it is generally lower, or on a level with the rice ground, the neceffary quantity is conveyed in pails or buckets, which are worked chiefly by the help of ropes.

10. Though a man cannot ftep in thefe rice grounds without being up to his knees, the Chinefe weed them three times in a fummer; and that with fuch care, that they pull up even the roots of every weed.

11. When the rice is ripe, which is known by its turning yellow, like wheat, it is cut down with a fickle, made into fheaves, and carried to a barn, where it is threfhed with flails pretty much like ours: the ftraw is removed with pitch-forks and fhovels, and the outer hufk of the grain is taken off by beating it with great wooden peftles, or a kind of mallet, after which it is fifted and winnowed: and laftly, to get off the under hufk, the grain is put between two mill-ftones, which are worked by a lever faftened to the upper one.

The two moft remarkable circumftances of this culture are, 1. The care which the Chinefe take not to let their plants be too clofe together, left they fhould rob one another of their food. 2. Their weeding their rice grounds three times in a fummer, which anfwers the end of the hoeings we recommend for the alleys between the beds of other grain.

The following is the defcription of a Chinefe plough, of which the Jefuits fent a model from China.

Plate I. *Fig.* 1. *AA* are the two fhafts, *BB* two fhares, *CC* the handles by which the driver guides the plough, and *D* a box in which the feed is put.

As the plough advances, the fhares open two furrows, and the feed in the box *D*, drops through an outlet *E* in its hinder part, and falls into a trough *F*, at the bottom of which are two holes, one anfwering to a pipe *G*, which communicates with a hollow bored in the piece of wood *H*, and terminates in an outlet at the back part of the fhare *I*: the other hole in the trough conveys the feed to the outlet *M* at the back part of the other fhare, through the pipe *NO*, as on the other fide before defcribed.

Now

Now it is eaſy to conceive, that the ſeed which drops out of the box D into the trough F, and from thence into the pipes $G\,H$ or $N\,O$, comes out at the openings I or M, and falls into the furrows as the ſhares open them: and the roller L which follows, fills up the furrow. But we ſee no moderator here, by the help of which more or leſs ſeed may be ſown at pleaſure. If the pipes and outlets are too large, the ſeed will drop in too great quantities; and if they are too ſmall, they will be apt to be choaked up, and the ſeed will not drop at all. Perhaps any one that has ſeen this plough work, might be able to anſwer theſe difficulties: but as it appears to me, I doubt it would not do for ſowing wheat according to our principles.

This is thought to be the plough which the Chineſe make uſe of to ſow rice: if ſo, their culture of that plant is ſtill more like the practice which we recommend for corn in general.

CHAP. IV.

Experiments on Leguminous Plants.

M. Eyma, of Bergerac near Bourdeaux, ſowed peas, beans, and kidney-beans, each ſeed a foot diſtant from another in the rows, and the rows two feet aſunder. They yielded a much more abundant crop, than any in the common huſbandry.

In April 1753, M. de Villiers ſowed 80 ſquare perches, of 22 feet each, with peas, in double rows. Not being provided with any proper inſtrument to hoe the alleys, he made uſe of a narrow angular kind of ſhare, which ſtirred only three or four inches on the outſide of the rows. Almoſt all the peas in that country were deſtroyed this year by a kind of vermine called vine-fretters. His were hurt the leaſt of any; which was probably owing to the greater vigour of the plants, or to the inſects being killed by the ſtirring of the ground. By a compariſon which he made of the produce of this ſpot, he found that it yielded ſix times as much as the ſame extent of the beſt land in thoſe parts. In a good year, the difference would not have been ſo great: but ſtill this experiment ſhews, that plants cultivated in the new way, are better able to reſiſt the inclemencies of the ſeaſons, and other accidents, than thoſe which are cultivated according to the old method.

The next year, being provided with M. Duhamel's drill and horſe-hoe, he ſowed peas, and barley. The alleys were but two feet, and

and two feet and an half wide, which rendered the horſe-hoeing very difficult in many places, and quite impracticable in others. This obliged him to contrive other methods of ſtirring the ground. The peas flouriſhed extremely, and produced more than the very beſt fields thereabouts. The barley, tho' ſown too thin, yielded likewiſe more than that of any other field.

In December 1755, M. Eyma planted the common ſort of garden-beans, in a middling ſoil, not dunged, but extremely well plowed a foot deep. The rows were two feet aſunder, and the plants a foot diſtant from each other. Theſe beans, which every one thought much too thin ſown, being aſſiſted by frequent hoeings, yielded a greater crop than any in the common way. M. Eyma, finding his beans begin to ripen, gave the alleys a good plowing, and, on the twenty-third of June, ſowed in each of them a row of red kidney-beans, which came up very well. A fortnight after, he plucked up the garden-beans, and gave the earth they grew on a ſlight hoeing. The kidney-beans proved the fineſt he ever ſaw. He purpoſes, as ſoon as they are off the ground, to replant it with garden-beans, and, he hopes, with better ſucceſs than before.

In 1755, M. de Villiers ſowed peas in a ſtrong heavy ſoil, in which no one had ever ventured to ſow any in the common huſbandry. They grew as high as if the ground had been ever ſo fit for them, and yielded half as much again as any ſown in the common way, beſides the ſaving in the ſeed, which, in peas, is about one half. They were ſown in double rows, and the alleys, which were two feet, and two feet and an half wide, were hoed with the ſingle cultivator.

With regard to the diſtance at which garden-beans ſhould be planted, Mr. Miller lays down as a general rule, that the larger beans ſhould be planted at a greater diſtance than the ſmall ones, and that thoſe which are firſt planted ſhould be put cloſeſt together, to allow for ſome miſcarrying. He therefore adviſes, where a ſingle row is planted, and that early, to put the beans two inches aſunder, and to allow thoſe of the third and fourth planting three inches; and when they are planted in rows a-croſs a bank, "the rows, ſays "he, ſhould be two feet and an half aſunder: but the windſor-beans "ſhould have a foot more ſpace between the rows, and the beans "in the rows ſhould be planted five or ſix inches aſunder. This "diſtance, continues he, may, by ſome perſons, be thought too

"great;

" great: but from many years experience, I can affirm, that the " same space of ground will produce a greater quantity of beans, " when planted at this distance, than if double the quantity of seeds " are put on it. In the management of these later crops of beans, " the principal care should be to keep them clear from weeds, and " any other plants, which would draw away their nourishment; to " keep earthing them up, and, when they are in blossom, to pinch " off their tops, which, if suffered to grow, will draw the nourish- " ment from the lower blossoms, which will prevent the pods " from setting, and so only the upper parts of the stems will be " fruitful: and another thing should be observed in planting of the " succeeding crops, which is, to make choice of moist strong land " for the later crops, for if they are planted on dry ground, they " rarely come to much.——In warm dry light land, all the late " crops of beans are generally attacked by the black insects, which " cover all the upper part of their stems, and soon cause them to " decay.

" The horse bean delights in a strong moist soil, and an open ex- " posure, for they never thrive well on dry warm land, or in small " inclosures, where they are very subject to blight, and are fre- " quently attacked by a black insect, which the farmers call the " black dolphin. These insects are often in such quantities, as to " cover the stems of the beans entirely, especially all the upper part " of them, and whenever this happens, the beans seldom come to " good: but in the open fields, where the soil is strong, this rarely " happens.

" These beans are usually sown on land which is fresh broken up, " because they are of use to break and pulverize the ground, as also " to destroy weeds; so that the land is rendered much better for " corn, after a crop of beans, than it would have been before, " especially if they are sown and managed according to the new hus- " bandry, with a drill-plough, and the horse-hoe, and to stir the " ground between the rows of beans, which will prevent the growth " of weeds, and pulverize the ground, whereby a much greater " crop of beans may, with more certainty, be expected, and the " land will be better prepared for whatever crop it is designed for " after.

" The season for sowing of beans is from the middle of February " to the end of March, according to the nature of the soil: the " strongest and wet land should always be last sown. The usual

" quantity

" quantity of beans, sown on an acre of land, is about three bushels: " but this is double the quantity which need be sown, especially ac- " cording to the new husbandry."

As neither M. Duhamel, nor his correspondents, are very particular in relation to the culture of this useful plant, we beg leave to add Mr. Miller's directions for the management of beans according to the new husbandry.

" The ground, says he, should be four times plowed before the " beans are set, which will break the clods, and render it much " better for planting. Then, with a drill-plough, to which a hopper " is fixed for setting of the beans, the drills should be made at three " feet asunder, and the spring of the hopper set so as to scatter the " beans at three inches distance in the drills. By this method, less " than one bushel of seed will plant an acre of land. When the " beans are up, if the ground is stirred between the rows with a " horse plough, it will destroy all the young weeds; and when the " beans are advanced about three or four inches high, the ground " should be again plowed between the rows, and the earth laid up " to the beans: and if a third plowing, at about five or six weeks " after, is given, the ground will be kept clean from weeds, and the " beans will stalk out, and produce a much greater crop than in " the common way.

" When the beans are ripe, they are reaped with a hook, as is " usually practised for peas; and after having lain a few days on the " ground, they are turned, and this must be repeated several times, " until they are dry enough to stack: but the best method is to tie " them in small bundles, and set them upright; for then they will " not be in so much danger to suffer by wet, as when they lie on the " ground; and they will be more handy to carry and stack, than if " they are low. The common produce is from twenty to twenty- " five bushels on an acre of land.

" The beans should lie in the mow to sweat, before they are " threshed out: for as the haulm is very large and succulent, so it is " very apt to give and grow moist: but there is no danger of the " beans receiving damage, if they are stacked tolerably dry, because " the pods will preserve the beans from injury; and they will " be much easier to thresh after they have sweat in the mow, than " before; and after they have once sweated, and are dry again, they " never after give.

" By the new husbandry, the produce has exceeded the old by

" more

" more than ten buſhels on an acre: and if the beans which are cultivated in the common method are obſerved, it will be found that more than half their ſtems have no beans on them; for by ſtanding cloſe, they are drawn up very tall, ſo the tops of the ſtalks only produce, and all the lower part is naked; whereas in the new method, they bear almoſt to the ground; and as the joints of the ſtems are ſhorter, ſo the beans grow cloſer together on the ſtalks."

CHAP V.

Experiments on Pot-herbs, &c.

M. de Chateau-vieux, being of opinion that if pot-herbs could be cultivated in the ſame manner as wheat is in the new huſbandry, a great expence in dung and labour might be ſaved, made the following experiments.

I begun, ſays he, by retrenching the dung: tho' the ſpot I choſe for my firſt trial had not received any for ſeveral years. It had indeed been well prepared by the plowing of the preceding year, when one half of it bore barley, and the other oats. I now made it into a bed, the middle of which was directly over the laſt year's furrow.

I plowed this bed, the 25th of September, 1751, in the ſame manner as if it had been intended for wheat. I planted on it a ſingle row of white cabbages, which I watered, to make them take root the better. The length of this bed was 160 feet, and its breadth ſix feet ſeven inches.

That I might be able to make a juſt compariſon between the cabbages of this bed, and thoſe of the kitchen garden, I planted a ſpot of ground in this laſt place, the ſame day, with the ſame ſort of plants. This ſpot had been extremely well dug, and greatly dunged, by the gardener, who took all poſſible care of theſe plants all the ſummer, and weeded and watered them as often as was neceſſary. Inſtead of cabbaging, moſt of them run up in height: upon which I plucked them up, and planted others in their ſtead.

I beſtowed the ſame care and culture on my rows of cabbages in the bed, as if they had been wheat.

The 9th of March, 1752. the alleys were ſtirred with the plough. The 25th of April, I gave them a ſecond ſtirring with the cultivator. The third of June, they had a third ſtirring, with the plough: and the 20th of July, I made my gardener hand-hoe them, for fear the plough ſhould damage ſeveral ſtalks of wheat which grew on the next bed, and which were bent, but not lodged.

Theſe cabbages were never watered, except once, which was at the time of planting them: and yet they were always criſp and firm, even in the hotteſt days. By this eaſy and expeditious culture, they attained all the perfection that could be wiſhed; and ſurpaſſed thoſe of the kitchen garden, as much in goodneſs, as they did in bulk. Moſt of them weighed between 15 and 18 pounds, and the ſmalleſt between eight and ten. The weight of all the plants which grew on this bed, was upwards of 840 pounds.

Toward the end of autumn, I prepared five other beds, to be ſown in the ſpring, in the ſame field as that of the cabbages, to which they lay in right angles. The form of this ſpot did not admit of making the beds more than 40 feet long. This ſpace being too ſmall to uſe the plough in, it was dug with the ſpade, and made into beds the latter end of November. The middle of the beds was raiſed pretty high, and a deep furrow parted them. The breadth from furrow to furrow was ſix feet. No dung was uſed.

The winter's froſt made the mould quite looſe and fine. I found it in ſo good condition, that I thought it needleſs to give it another digging before I ſowed it; which is very remarkable: for as theſe beds were not ſown till the 4th of May, the ground had conſequently not been ſtirred for upwards of five months.

I only made a ſhallow furrow in the middle of each bed, in one of which I ſowed beet, in two others carrots, and in the other two ſcorzoneras. The mould was in a due degree of moiſture: the plants came up very well: they were thinned wherever they grew too thick, ſo as to leave a diſtance of 14 or 15 inches between the beet roots, ſeven or eight inches between the carrots, and four or five inches between the ſcorzoneras. None of theſe plants were watered at all.

This ſpot being, as I before ſaid, too ſmall to admit the plough, the alleys between theſe beds were ſtirred by hand, with a ſpade, the 15th of June, 27th of July, and 6th of September. The leaves of the plants were three or four times larger than thoſe of the ſame kind of plants in the kitchen garden; and though the rows were ſix feet aſunder, the leaves of the carrots met in many places, in the middle of the furrows between the beds.

The beet roots were dug up the 25th of October. They were all nearly of the ſame ſize, *viz.* five or ſix inches in diameter, towards the

the top, or thickeſt part; which was much larger than any in the kitchen garden.

The carrots were taken up the 8th of November. My gardener, who, when he ſowed them, would have betted all he had in the world, that the crop would not be worth the digging, was aſtoniſhed at their ſize. They were from 18 to 20 and 25 inches long, and from two and a half to three and a half and four inches in diameter, and weighed from 25 to 30 and 33 ounces each.

The ſcorzoneras throve well, and their leaves were very large: till, on the 17th of Auguſt, when I had not ſeen them for a week, I found them totally changed, their leaves withered, and hanging on the ground. Upon opening a furrow on one ſide of them, to lay their roots bare, I found them entirely covered with ſmall white ſlugs. I filled up part of this furrow with ſoot, in hopes that its bitterneſs would drive them away. For ſome days, there were much fewer of them, and the plants ſeemed to recover a little ſtrength: but their enemies returned in ſo great numbers, that they ſoon deſtroyed them all, a very few roots excepted, which, notwithſtanding the injury they had received, were larger at the end of ſix months, than thoſe in the kitchen garden were at the end of nineteen.

Beſides the great advantage already mentioned, which all theſe plants had over thoſe of the ſame kind in the kitchen-garden; they had two others, well worthy our attention. In the firſt place, they were much more tender and delicate, and their flavour higher and more pleaſing to the palate: and ſecondly, they required much leſs time to boil them, than thoſe raiſed in the kitchen garden. I do not impute this ſolely to my not uſing dung: the new huſbandry had likewiſe its ſhare in this improvement; the juices of plants being certainly moſt perfect in ground that is often ſtirred: the ſun and air have then an eaſier acceſs to the plants, and keep them ſound; and the dews penetrate to their roots, as deep as the mould is ſufficiently looſe. I am perſuaded that the perfection of theſe plants, was entirely owing to theſe cauſes. To have raiſed them in beds, and given them the ſame culture as wheat receives, would have been but an imperfect experiment, had I not likewiſe baniſhed the uſe of dung. This laſt point was abſolutely neceſſary, in order to know with certainty what earth alone is capable of doing, when managed according to the principles of the new huſbandry.

In 1753, I repeated my experiments on the ſame plants, *viz.*

 cabbages,

cabbages, beet-roots, carrots, and ſcorzoneras; and all of them were as fine, and well flavour'd, as before.

I likewiſe planted a bed of colliflowers this year, which were tranſplanted the 9th of June. On the 20th of Auguſt, I cut the two firſt heads, which were very fine, and of an excellent taſte. Cardoons, cultivated in the ſame manner, grew very fine, though they were greatly retarded by a ſhower of hail.

I am now trying to raiſe more laſting plants, by cultivating them according to the new huſbandry. To this end, I have laid down a bed 32 toiſes long and ſix feet wide, and planted it, the 24th of March, with a row of aſparagus, which have made good ſhoots this firſt year. I ſhall continue to cultivate them with all due care, and wait with patience till the year 1755 ſhall ſhew what the event will be.

I have ſeveral beds ſix feet wide, which I have planted with ſingle rows of ſtrawberries. The vigor of the plants, the largeneſs of the leaves, and the very great number of roots, give me room to expect that the fruit will be very large and plentiful.

The ſucceſs I have already had, the eaſe with which this culture is performed, the advantage of not uſing dung, and that of being eaſed of the trouble of watering, ſo neceſſary in kitchen gardens, that, in hot weather, it takes up almoſt the whole of one man's time, are conſiderations of ſuch weight, as determined me to continue theſe experiments.

Accordingly. in 1754, I raiſed the ſame plants again in beds, and with the ſame ſucceſs: for they were equally beautiful and good. Tho' the year was very hot and dry, I watered none of them, except at the time of tranſplanting, to make them take the better. Thoſe that were left where they were ſown, were not watered at all. This ſhews how much the new huſbandry preſerves a moiſture in the earth.

The ſtrawberries, this year, were admirable, extremely large, finely ſcented, and of a very high flavour.

The aſparagus, which was in its ſecond year, was as fine as any in the beſt cultivated gardens.

Artichokes planted at the end of May, produced their firſt fruit in September, which was, in general, from 12 to 15 inches in circumference. Their leaves entirely covered the beds ſix feet wide.

I have raiſed even melons in the ſame manner, without any dung,

or

or hot bed, and without bell-glaſſes, or any glaſs frame to cover them. I ſowed them as I would have done wheat. The plants came up perfectly well, and the fruit was ſo large and finely flavour'd, that it might claim a preference in all reſpects to any that grew in my garden.

I raiſed the ſame plants again in 1755 and 1756, in the ſame manner, and with the ſame ſucceſs as before. They have always been larger, better taſted, and in every reſpect finer, than thoſe of my kitchen garden. Nothing could be more ſtriking, than, in 1755, a hot dry year, to ſee theſe plants always green, and in great vigor, thrive without any alteration, whilſt thoſe in gardens, which were watered every day, droop'd during part of the day, and grew but very ſlowly.

We may place the greater confidence in theſe experiments on pot-herbs, as they have been cultivated in the ſame manner for ſeveral years, and always with the ſame ſucceſs. The beauty, largeneſs, and vigor of the plants, cannot be imputed to dung or other manure, for none was uſed: nor did they want watering, to which I never had recourſe, but when any of them were tranſplanted. It is therefore to the culture that their flouriſhing growth muſt be aſcribed: and this is the more remarkable, as it is well known, that, in the common management of kitchen gardens, if the ground was not to be dunged for ſeveral years, it would produce only poor and ſtinted plants.

M. de Chateau-vieux extended the new huſbandry to the culture of the *teazle*, or fuller's thiſtle, which grew to a ſurprizing height, and produced an extraordinary number of the fineſt and beſt heads that the fullers of that country had ever ſeen.

This plant is of ſuch importance to the woollen manufactory, in which it is uſed for raiſing the knap upon cloth, that we muſt beg leave to add here Mr. Miller's directions for the culture of it.

" It is propagated," ſays he," by ſowing the ſeeds in March,
" upon a ſoil that has been well dried. About one peck of this ſeed
" will ſow an acre; for the plants ſhould have room to grow; other-
" wiſe the heads will not be ſo large, nor in ſo great quantity.
" When the plants are come up, you muſt hoe them in the ſame
" manner as is practiſed for turneps, cutting down all the weeds,
" and ſingling out the plants to about ſix or eight inches diſtance;
" and as the plants advance, and the weeds begin to grow again, you
" muſt hoe them a ſecond time, cutting out the plants to a wider
" diſtance; for they ſhould be, at laſt, left at leaſt a foot aſunder:

" and

" and you ſhould be particularly careful to clear them from weeds, " eſpecially the firſt ſummer; for when the plants have ſpread ſo as " to cover the ſurface of the ground, the weeds will not ſo readily " grow between them. The ſecond year after ſowing, the plants " will ſhoot up heads, which will be fit to cut about the beginning " of Auguſt; at which time they ſhould be cut and tied up in " bunches, ſetting them in the ſun, if the weather be fair; but if " not, they muſt be ſet in rooms to dry them. The common pro- " duce is about an hundred and ſixty bundles or ſtaves upon an " acre, which they ſell for about one ſhilling a ſtave."

M. Duhamel relates, that a friend of his had exceeding large carrots, by planting young carrots in a kitchen-garden, a foot aſunder. Thoſe which were ſown thicker, remained ſmall and ſtinted. Theſe large carrots were tender and of a good taſte.

From this, and ſome other experiments of the ſame kind, he draws the following concluſions. 1. That plants extend their roots farther than is generally imagined. 2. That it is proper to give each plant ſufficient room to extend its roots in ſearch of its neceſſary food: and 3. That plants which grow too thick, hurt one another, and yield but ſmall productions.

In 1755, M. Duhamel himſelf ſowed a piece of ground with carrot, beet, and ſcorzonera ſeed, and planted the remainder of it with young cabbages. All theſe plants were hoed, according to the practice of the new huſbandry, and not watered at all. The cabbages were very fine, and the carrots, beet-roots, and ſcorzoneras, the fineſt that had ever been ſeen.

In 1756 he ſowed the ſame ground again, as before, and with the like ſucceſs; excepting that the beets and carrots were too thin, becauſe ſome of the ſeed did not grow. The cabbages were exceeding fine: and kidney beans, which he added this year, came to great perfection.

M. Barbuat, M. D. towards the latter end of Auguſt, 1755, planted winter cabbages two feet aſunder, and ſet three leeks between each cabbage. He ſtirred the ground about them three times, at the diſtance of ſix weeks between each ſtirring. They became larger and better taſted, than thoſe that were cultivated in the common way.

In February, he ſowed onions, which having been neglected till towards the middle of May, were moſt of them choaked with weeds. He ordered theſe weeds to be pulled up, and, contrary to the advice of all the gardeners near him, gave his onions, which were thin ſown,

two

two hoeings. Moſt of them grew to four and four inches and an half in diameter.

M. Duhamel concludes his account of this culture of pot-herbs, with the following extract of a letter from a gentleman near Lyons.

"My pot-herbs in beds are the admiration of all who ſee them. "My colliflowers were very fine, and on the fifth of July (1755) "run up to ſeed, and in all probability will produce a great deal; "which was never known before in this country.* I have cabbages "which, I dare ſay, will weigh upwards of 45 pounds. I had "ſome laſt year which weighed 35 pounds, but the ground was "not ſo well cultivated then, as it is now, nor were they ſo early. "They have ſuffered nothing from the drought; but, on the con-"trary, the warmer the weather has been, the finer they have "grown. They have not been watered at all: nor have my "carrots, which are now a foot in circumference: and I have cab-"bage lettices which weigh five pounds. One great advantage "which I find in the new huſbandry, is that plants are preſerved "from the danger of too much rain, or too great drought. The "earth, when well cultivated, is always in a moiſt ſtate. The "more I reflect on this new method of culture, the more I admire "it. None but thoſe who are thorough judges of agriculture, "can foreſee the immenſe advantages that will hereafter attend "it."

The great uſe that may be made of ſome of the plants treated of in this chapter, for the food of cattle, ſeems to have eſcaped M. Duhamel's attention. As their ſize, and conſequently their quantity, is capable of being prodigiouſly increaſed by means of the new huſbandry, this conſideration is the more important. We ſhall therefore endeavour to ſupply our author's deficiency in this re-ſpect,

* The colliflower, as Mr. Miller obſerves, has been much more improved in England, than in any other part of Europe. In France, they rarely have colliflowers till Michaelmas; and Holland is generally ſupplied with them from England. In many parts of Germany, there was none of them cultivated till within a few years paſt; and moſt parts of Europe are ſupplied with ſeeds from hence. This plant was firſt brought to England from the iſland of Cyprus, where it is ſaid to be in great perfection at preſent; tho' it is ſuppoſed to have been originally brought thither from ſome other country. It was not brought to any degree of perfection in England, till about 1680, at leaſt not to be ſold in the markets; and ſince the year 1700, they have been ſo much improved in England, that ſuch of them as before were greatly admired, would at preſent be little regarded.

ſpect, by borrowing from Mr. Miller what is pertinent to our ſubject.

" Where carrots," ſays he, " are deſigned to have large roots," (which certainly will always be the caſe when they are intended for fodder,) " they muſt never ſtand too cloſe, nor ſhould they have " any other crop mixed with them.——This root has long been " cultivated in gardens for the table, but has not till of late years " been cultivated in the fields for cattle, nor has it been practiſed as " yet, but in few parts in England. It is therefore greatly to be " wiſhed, that the culture of it was extended to every part of England, " where the ſoil is proper for the purpoſe: for there is ſcarce " any root yet known, which more deſerves it, being a very hearty " good food for moſt ſorts of animals. One acre of carrots, if well " planted, will fatten a greater number of ſheep, or bullocks, than " three acres of turneps, and the fleſh of theſe animals will be firmer " and better taſted. Horſes are extremely fond of this food, and " for hogs there is not any better. I have alſo known theſe roots " cultivated for feeding of deer in parks, which has proved of excellent " uſe in hard winters, when there has been a ſcarcity of " other food, at which times great numbers of deer have periſhed " for want; and thoſe that have eſcaped, have been ſo much reduced, " as not to recover their fleſh the following ſummer; whereas " thoſe fed with carrots have been kept in good condition all the " winter, and upon the growth of the graſs in the ſpring, have been " fat early in the ſeaſon; which is an advantage, where the graſs is " generally backward in its growth.

" There is alſo an advantage in the cultivation of this root, beyond " that of the turnep, becauſe the crop is not ſo liable to fail: " for as the carrots are ſown in the ſpring, the plants generally come " up well; and unleſs the months of June and July prove very bad, " there is no danger of the crop ſucceeding: whereas turneps are " frequently deſtroyed by the flies at their firſt coming up; and in " dry autumns they are attacked by caterpillars, which in a ſhort " time devour whole fields: but carrots are not attacked by theſe " vermin. Therefore every farmer who has a ſtock of cattle or " ſheep, ſhould always have a ſupply of theſe roots, if he has land " proper for the purpoſe, which muſt be light, and of a proper " depth to admit of the roots running down.

" In preparing of the land for carrots, if it has not been in tillage " before, it ſhould be plowed early in autumn, and then plowed

" a-croſs

" a-crofs again before winter, laying it up in high ridges to mellow " by the froft: and if the ground is poor, there fhould be fome " rotten dung fpread over it in winter, which fhould be plowed in " about the beginning of February: then in March, the ground " fhould be plowed again to receive the feeds; in the doing of " which, fome farmers have two ploughs, one following the other " in the fame furrow, fo that the ground is loofened a foot and a " half deep: others have men with fpades following the plough in " the furrows, turning up a fpit of earth from the bottom, which " they lay upon the top, leveling it fmooth, and breaking the clods: " the latter method is attended with a little more expence, but is " much to be preferred to the firft; becaufe in this way the clods " are more broken, and the furface of the ground is laid much " evener.

" If the land has been in tillage before, it will require but three " plowings; the firft juft before winter, when it fhould be laid in " high ridges; the fecond crofs plowing fhould be in February; " after which, if it is well harrowed to break the clods, it will be " of great fervice: the laft time muft be in March, to receive the " feeds: this fhould be performed in the manner before mentioned. " After this third plowing, if there remain great clods of earth un- " broken, it will be proper to harrow it well before the feeds are " fown. One pound and a half of feeds will be fufficient for an " acre of land: but as they are apt to adhere together, fo it renders " them more difficult to fow even than moft other forts: therefore " fome mix a quantity of dry fand with their feeds, rubbing them " well together, fo as to feparate the carrot feeds from each other, " which is a good method. After the feeds are fown, they muft be " gently harrowed in to bury them; and when the plants come up, " they fhould be hoed.

" But in order to preferve your carrots for ufe all the winter and " fpring, you fhould, about the beginning of November, when the " green leaves are decayed, dig them up, and lay them in fand in " a dry place, where the froft cannot come to them, taking them " out from time to time as you have occafion for them, referving " fome of the longeft and ftraiteft roots for feed, if you intend to " fave any; which roots fhould be planted in the middle of Febru- " ary, in a light foil, about a foot afunder each way, obferving to " keep the ground clear from weeds: and about the middle of Au- " guft, when you find the feed is ripe, you muft cut it off, and carry "it to a dry place, where it ſhould be expoſed to the ſun and air "for ſeveral days, to dry: then you may beat out the ſeed, and put "it up in bags, keeping it in a dry place until you uſe it. This "ſeed is ſeldom eſteemed very good after the firſt or ſecond year at "moſt, but new ſeed is always preferred; nor will it grow after it "is more than two years old."

Parſneps are another excellent, wholeſome, and very nouriſhing food for cattle. Their culture is the ſame as that of carrots, with which they may be ſown on the ſame ground; obſerving, if you would have the roots of either grow to their full ſize, to thin them ſo as to leave a ſpace of ten inches or a foot between each plant, and to keep them clear from weeds by frequent hoeing. When the leaves begin to decay, the roots may be dug up for uſe, and kept in ſand, in a dry place. Parſnep ſeeds ſeldom grow after they are above a year old.

We could wiſh that M. Duhamel, or his correſpondents, had tried the culture of parſley according to the new huſbandry, in which there is no doubt of its ſucceeding well, and proving of great benefit to ſheep. "The common parſley, ſays Mr. Millar, is, by ſome "ſkilful perſons, cultivated in fields for the uſe of ſheep; it being "a ſovereign remedy to preſerve them from the rot, provided they "are fed twice a week for two or three hours each time with this "herb: but hares and rabbets are ſo fond of it, that they will come "from a great diſtance to feed upon it; and in countries where theſe "animals abound, they will deſtroy it, if it is not very ſecurely "fenced againſt them: ſo that whoever has a mind to have plenty "of hares in their fields, by cultivating parſley, will draw all the "hares of the country to them.——The beſt time for ſowing it in "the fields is about the middle or latter end of February: the "ground ſhould be made fine, and the ſeeds ſown pretty thick, in "drills drawn about a foot aſunder, that the ground may be kept "hoed between the drills, to deſtroy the weeds, which, if permitted "to grow, will ſoon over-run the parſley. Two buſhels of ſeed "will ſow one acre of land.——The roots of the great garden-"parſley will grow, if ſufficient room is given them, to the ſize of "a middling parſnep, and are greatly eſteemed by the Dutch for "their *water ſouches*. They may alſo be boiled and eaten as young "carrots, and are very palatable and wholeſome, eſpecially for thoſe "who are troubled with the gravel.

"The *napus ſylveſtris*, or wild navew, generally known by the

"name

" name of rape or cole seed, is much cultivated in the isle of Ely, " and some other parts of England, for its seed, from which the " rape oil is drawn: and it hath also been cultivated of late years, " in other places, for feeding of cattle, to great advantage.——The " cole seed, when cultivated for feeding of cattle, should be sown " about the middle of June. The ground for this should be pre- " pared in the same manner as for turneps. The quantity of seeds " for an acre of land, is from six to eight pounds, and as the price " of the seeds is not great, so it is better to allow eight pounds; for " if the plants are too close in any part, they may be easily thinned " when the ground is hoed. When the plants have put out six " leaves, they will be fit to hoe; which must be performed in " the same manner as is practised for turneps."

CHAP. VI. SECT. I.

Of the common culture of Turneps.

THIS root is now cultivated more for feeding and fattening of cattle, and particularly sheep, than for the food of men.

It is sown in different seasons of the year, but chiefly at the end of June, during all July, and in the beginning of August; taking advantage of every rain that falls during this time; for that is necessary to make the seed sprout.

It is sown in land that has been well dunged and thoroughly plowed. The seed is sown by hand, as equally as possible, and covered with the harrow, about an inch deep; for if it were covered deeper, there would be danger of its not rising.

When the turneps appear above ground, the farmer examines where they have failed, in order to sow fresh seed, which he covers with the rake. When the turneps are about the bigness of a finger's end, they are carefully hoed, to clear them from weeds which would hurt them greatly, and to thin the plants where they are too thick: for a few large turneps are more profitable than a greater number of small ones.

These plants scarce require any other culture: only they must be shelter'd from all kind of cattle, and especially hogs, who would soon turn up the whole field in search of these roots, which they are very fond of.

SECT. II.

Of the culture of Turneps according to the new husbandry, by M. Duhamel.

A Light sandy soil, somewhat moist, is the fittest land for all sorts of turneps: but with the help of good culture they may be raised in almost any soil, except chalk and clay, where they seldom do well.

It is proper to observe that all roots, such as turneps, parsneps, carrots, *&c.* thrive best where there is great depth of mould. We trenched our whole garden three feet deep. All the pot-herbs grew very fine, and the roots in particular were of a surprising length and bigness.

This shews that the ground intended for turneps ought to be well stirred, and as deep as possible: and as turneps delight in a light soil, we must endeavour to bring the strong soils into that state, by the two means we have already mentioned as capable of producing that effect, *viz.* dung and plowing. If dung is wanting, the plowings must be repeated in proportion to the strength of the soil.

Turneps may be sown from the middle of May to the beginning of August, but the usual season is about midsummer. Their success depends greatly on the nature of the soil and the state of the weather.

An ounce of seed will sow as much land when drilled, as a pound will in the common way; because when care has been taken to sow only the necessary quantity of seed, there will be no occasion to thin the plants afterwards, when they are hoed.

The best way is to sow them in single rows six feet asunder. Mr. Tull sowed them in double rows; but they did not do well. He likewise sowed them in single rows, but at the distance of only three feet. These yielded more turneps than a neighbouring field which was sown and managed in the common way. But it is still better to leave a space of six feet between the rows; and if the alleys are well plowed to the depth of five or six inches, the turneps will thrive wonderfully, even tho' no other moisture falls but the dew, which will sink into the earth to their roots.

Notwithstanding Mr. Tull's experiment, I would sow them in double rows; or, if in single rows, those rows should be but four feet asunder. That is the space which is left in Languedoc between the rows of vines, and which is plowed with oxen.

If

If one was ſure of having rain immediately after the turneps are ſown, it would be right to ſow them very ſhallow: but if no rain happens, they are beſt deeper in the earth, becauſe they meet there with moiſture ſufficient to make them grow.

Mr. Tull, by drilling the ſeeds alternately at different depths in the earth, was ſure to ſucceed in one part or other, whether the ſeaſon was wet or dry. If wet, the ſeed ſlightly covered ſprouted firſt; and in dry ſeaſons that which lay deepeſt was the firſt that roſe.

This is an eaſy way of having two growths of turneps in the ſame field. There is another way, which is, to ſow the ſeed of the laſt gathering, and ſeed that is two years old; for this laſt is longer before it riſes than the new. An advantage attending the turneps riſing at different times, is, that they may thereby eſcape the fly or grub, which often entirely deſtroy them. It is obſerved, that theſe flies often come ſuddenly in great ſwarms, and deſtroy the turneps as they riſe; and that they ſometimes diſappear as ſuddenly; ſo that the turneps which riſe a few days after in the neighbouring field, are not at all injured by them: conſequently, when the turneps of the ſame field riſe at different times, one or other may eſcape the ravage of theſe inſects; for they deſtroy them only when in their ſeedling leaf.

One of the moſt effectual ways to preſerve turneps from theſe inſects, is, to run a heavy roller over the whole field, acroſs the rows. This rolling hardens the ſurface of the earth ſo that they can neither get in or out, by which means they are deſtroyed. But this preſſure of the earth would be very hurtful to the turneps, if the ground had not been deeply plowed, if it was moiſt, or if it was ſtiff and apt to bind. Theſe inconveniencies are however partly remedied, by hoeing the alleys as ſoon as the turneps have put forth their large leaves; for then they have nothing to fear from the inſects, which the hoeing likewiſe helps to deſtroy. The horſe-hoe is the only inſtrument with which this work can well be done, the earth being often ſo hard, that the hand-hoe would only ſcratch it.

When the ſeaſon has been kindly, and all the ſeeds have grown, and the plants have not ſuffered by the fly or other inſects, they muſt be thinned early, that the earth may not be exhauſted by plants which are not intended to remain; for thoſe that are left ſhould be about a foot aſunder.

When the turneps thrive well, only each alternate alley need be hoed at one time, and the others a few days after: becauſe it is better to feed the plants by degrees, by dividing the hoeings in this manner, than

than to give them a great deal of food, by hoeing all the alleys at once, and afterwards leave them double the time without any culture at all*.

This method of hoeing the alternate alleys, is attended with this advantage, that in case of hot dry weather, the plants are not killed; and heavy rains will do them the less damage: but it will not so effectually destroy weeds, which is always one of the great objects of the new husbandry.

Tho' the horse-hoe has approached the turneps as near as possible, it will be necessary to hand-hoe the spaces between them. This may be done at a small expence, as the other hoe has already stirred almost all the ground. An expert husbandman will bring the horse-hoe within two or three inches of the plants.

When the turneps are grown large, there is no occasion to come so near them, lest their roots be hurt: nor is it necessary to hoe them, till they are about the bigness of one's finger's end.

All plants sown in single rows, are greatly benefited by this hoeing of the alternate alleys. For, 1. Four of these hoeings, which cost no more than two entire ones, are almost as beneficial to the plants as four complete hoeings. 2. A plant which finds a great deal of nourishment on one side, is better able to thrive without receiving so much on the other. 3. If, in hoeing very near the plant, some of the roots are broke, those on the side not hoed, supply the wants of the plant, till the broken roots have made fresh shoots. 4. We may therefore ap-

* "When the turneps are sown in drills," says Mr. Miller, Art. *Rapa*, "it will "be the best way to hoe between every other row at first, and some time after to hoe "the alternate intervals, by which method the plants will receive more benefit from "the often stirring the ground, than they would do, if all the intervals were hoed at "one time; and the plants will be in less danger of suffering from the earth being "thrown up too high on some rows, while others may be left too bare of earth: but "when the earth has been thrown up on one side of the drill, it may be turned down "again before the next interval is hoed, and this alternate moving of the earth will "prepare the ground very well for the succeeding crop, as well as greatly improve "the turneps: but as this plough cannot well be drawn nearer to the drills than two "or three inches, the remaining ground should be forked, to loosen the parts, and "make way for the fibres of the roots to strike out into the intervals; otherwise, if "the land is strong, it will become so hard in those places which are not stirred, as "to stint the growth of the turneps; and this may be done at a small expence: a "good hand will perform a great deal of this work in a day, and whoever will make "the trial, will find their account in practising it, especially on all strong land, "where the turneps are much more liable to suffer from the binding of the ground, "than they will be on a loose soil: but yet, in all sorts of ground, it will be of great "service to practise this."

proach

proach nearer to the turneps without fear of hurting them, or of forcing them out of the earth. 5, When a farmer has a great quantity of turneps to hoe, they are sooner supplied by this culture, than they possibly could if all the alleys were to be hoed.

While the turneps are young, a furrow must not be left open near them; because the earth about them would become too dry: but there is no danger of this in the autumn when they are grown strong, and the earth is moist. I do not think it adviseable neither to leave a furrow open near them during the winter, because they would be in greater danger of being hurt by the frost.

One alternate hoeing, or, which is the same thing, two half hoeings will be sufficient when the turneps are sown late. But when they are sown early, and many weeds grow, one hoeing will not be enough.

By means of this culture, I have seen turneps which weighed from sixteen to nineteen pounds; and we may depend on their weighing one with another twelve pounds apiece in a good soil, which is after the rate of 576 pound weight of turneps on a square perch of 24 feet, and near sixty thousand weight upon an arpent. If, in a square of 24 feet, which is the great perch, turneps are planted in rows six feet asunder, there will be four rows, containing each 24 turneps, in all 96, weighing 1152 pounds; consequently the arpent will yield 115200 weight of turneps.

The chief use of turneps is, to feed cattle in the winter and spring, till there is a sufficiency of grass for their pasture; and as they are pulled up only as they are wanted, they take up the ground which should be sown with wheat, and sometimes even when it should be sowed with spring corn. In the new husbandry, they are no hindrance to sowing; for as the alleys are in good tilth, three rows of corn may be sown seven inches asunder between the rows of turneps; and when the turneps are pulled, the ground they grew on is hoed, and becomes the alleys between the beds of corn.

It is well known that oxen and cows are very fond of this food, which fattens them, and increases the milk of cows. Sheep too eat it readily, and thrive upon it*, when they have been used to it early; but they do not relish it when it has not been offered them till they are grown old: but if they are kept fasting two or three days, most

* Parsley corrects the inconveniencies which may arise from the too great moisture and coldness of the turneps, and therefore must be of singular use in wet low pastures. See p. 322.

of them eat it; and when they have once tasted it, they become very fond of, and feed kindly upon it. In some places, they feed their lambs with turneps till the middle of April, tho' they then begin to run up to seed; and farmers chuse rather to do this, than to let them hurt their sain-foin, luserne, clover, &c.

When sheep are fed upon turneps, they must not be suffered to go at large in the field: they would spoil more turneps in a fortnight than would feed them a whole winter: but they are given them three different ways.

The first is, by inclosing a piece with hurdles, proportioned to what they can eat in one day, and the hurdles are removed every morning.

Sheep eat only the leaves and the heart of the turneps, so that great part of them remains in the earth. 'Tis true these fragments of the roots are afterwards pulled out with a fork with iron prongs: but besides that all of them are not pulled up, the sheep do not relish those rinds of turneps which begin to rot, and are tainted with their urine, dung, &c.

The second method differs from the first only in pulling the turneps as far as they are hurdled off, before the sheep are sent in. They then eat them better, because the food is fresh and in good condition. Besides, they are more easily pulled when entire, than when pieces of them remain.

The third way consists in pulling the turneps, and carrying them into another field, or laying them on a spot of grass, where the sheep eat them all up. The expence of carrying the turneps, is compensated by saving the price of the hurdles, and the trouble of moving them every day.

This method is necessary when the field on which the turneps grow, is wet: for 1. The sheep would bury and trample upon part of the turneps, which would be lost. 2. In treading that wet earth, they would poach it, and render it unfit for corn. 3. By this means, a field may be dunged, which wants it more than that the turneps grew on. 4. This must necessarily be done, if wheat has been sown in the alleys between the rows of turneps.

Turneps are always carried off the field, when they are intended to fatten the larger sorts of cattle.

SECT.

SECT. III.

Experiments on Turneps cultivated according to the new Husbandry.

IN 1754, M. de Chateau-vieux sowed turneps on beds, in two rows. They suffered greatly for want of rain, and none of them grew to the size they would have done in a more favourable season. Some of them weighed eight pounds: but their general weight was three or four.

In 1755, M. de Chateau-vieux sowed some beds with one row, some with two, and others with three rows. They were afterwards thinned so that the plants were a foot asunder in the rows. Those sown in one row were the largest, and, in general, the most equal. Some of them weighed 14 pounds, and most of them, from seven to eight. In the other rows, they did not weigh so much; but they were in greater number. He had not yet repeated his experiments often enough to determine what number of rows on each bed will yield the greatest crop.

In 1755, M. Duhamel sowed turneps on beds which had just been reaped, and which, he says, he intended to plant with luserne in the spring. They were sown in three rows. They came up too thick, and, for want of thinning, remained small. However, the arpent yielded him four loads of leaves and roots.

He makes the following calculation of the produce of an arpent, sown in single rows, and cultivated according to the new husbandry, supposing the turneps to weigh only six pounds each; which is very moderate.

Let a surface of 36 square toises, which is nearly the extent of an arpent, be formed into beds of four feet wide, which is sufficient for one row of turneps. These beds will be 216 feet long, and consequently will contain that number of turneps planted a foot asunder. Those 216, multiplied by 54, the number of beds, will give 11664 turneps for the product of the arpent, which, multiplied by six, the weight of each turnep, will give 69984 pounds for the weight of all the turneps on the arpent. This may be looked upon as a very considerable crop: and I have reason to believe, adds our author, that in a good year, it will be double what I have here calculated.

In 1755, M. Duhamel sowed turneps in a field, on beds. They were extremely fine, and many of them were 29 inches in circumference.

We ſhall cloſe this chapter with ſome directions of Mr. Miller for the general culture of this plant.

" Turneps, ſays he, delight in a light, ſandy, loamy ſoil, which " muſt not be rich; for in a rich ſoil they grow rank and are ſticky: " but if it be moiſt, they will thrive the better in ſummer, eſpecially " in freſh land, where they are always ſweeter than upon an old worn- " out, or a rich ſoil.

" The common ſeaſon for ſowing of turneps, is any time from the " beginning of June to the middle of Auguſt, or a little later; " though it is not adviſeable to ſow them much after, becauſe, if the " autumn ſhould not prove very mild, they will not have time to ap- " ple before winter, nor will the roots of thoſe which are ſown after " the middle of July grow very large, unleſs the froſt keeps off long " in autumn.——Two pounds of ſeed are full ſufficient for an acre " of land (ſown in broad-caſt) but one pound is the common al- " lowance*.

" Theſe ſeeds ſhould always be ſown upon an open ſpot of ground: " for if they are near hedges, walls, buildings, or trees, they will " draw up, and be very long topt, but their roots will not grow to " any ſize. They are ſown in great plenty in the fields near London, " not only for the uſe of the kitchen, but for food for cattle in win- " ter, when there is a ſcarcity of other food: and this way is become " a great improvement to barren ſandy lands, particularly in Nor- " folk, where, by the culture of turneps, many perſons have doubled " the yearly value of their ground.

" When the plants have got four or five leaves, they ſhould be " hoed to deſtroy the weeds, and to cut up the plants which are too " thick, leaving the remaining ones about ſix or eight inches aſunder, " which will be room enough for the plants to ſtand for the firſt hoe- " ing; and the ſooner this is performed when the plants have four " leaves, the better they will thrive: but in the ſecond hoeing, which " muſt be performed about three weeks or a month after the firſt, " they ſhould be cut up, ſo as that the remaining plants may ſtand " fourteen or ſixteen inches diſtance, or more, eſpecially if they are " deſigned for feeding of cattle: for where the plants are allowed a " good diſtance, the roots will be proportionably large: ſo that what " is loſt in number, will be overgained by their bulk, which is what " I have often obſerved. But in places where they are ſown for the

* Three or four ounces, ſays Mr. Tull, is the uſual quantity to drill.

" uſe

" uſe of the kitchen, they need not be left at a greater diſtance than
" ten inches or a foot, becauſe large roots are not ſo generally eſteemed
" for the table.

" It is not many years ſince the practice of ſowing turneps for
" feeding cattle, has been in general uſe. How it happened that
" this improvement ſhould have been ſo long neglected in every
" part of Europe, is not eaſy to determine; ſince it is very plain that
" this piece of huſbandry was known to the antients: for Columella,
" in treating of the ſeveral kinds of vegetables, which are proper for
" the field, recommends the cultivating *rapa* in plenty; becauſe,
" ſays he, thoſe roots which are not wanted for the table, will be
" eaten by the cattle. And yet this plant was not much cultivated
" in the fields till of late years, nor is the true method of cultivating
" turneps yet known, or at leaſt it is not practiſed, in ſome of the
" diſtant counties of England: for in many places the ſeed is ſown
" with barley in the ſpring, and thoſe plants which come up, and
" live till the barley is cut, produce a little green for the ſheep to pick
" up, but never have any roots. In other places, where the turnep
" ſeed is ſown by itſelf, the method of hoeing them is not underſtood;
" ſo that weeds and turneps are permitted to grow together, and
" where the tnrneps come up thick in patches, they are never thinned;
" ſo that they draw up to have long leaves, but never can have good
" roots, which is the principal part of the plant, and therefore
" ſhould be chiefly attended to."

Some very curious farmers, continues Mr. Miller, have of late cultivated turneps, by ſowing the ſeed in rows, with the drill-plough.
" In ſome places, the rows are thrown three feet aſunder, in others
" four, in ſome five, and ſome ſix. The latter has been recom-
" mended by ſome, as the moſt proper diſtance; and although
" the intervals are ſo large, yet the crop produced on an acre has
" been much greater, than upon the ſame quantity of land where
" the rows have been but half this diſtance; and upon all the fields
" which have been tilled, the crops have greatly exceeded thoſe which
" have been hand hoed. The late lord viſcount Townſhend was at
" the expence of making the trial of theſe two diffeient methods of
" huſbandry, with the greateſt care, by equally dividing the ſame
" fields into different lands, which were alternately ſown in drills,
" and the intermediate lands in broad caſt. The latter were hoed by
" hand, in the common method, and the other cultivated by the
" hoeing plough; and when the roots were fully grown, his lord-

" ſhip had an equal quantity of land, which had been ſown in diffe-
" rent methods, meaſured, and the roots drawn up and weighed,
" and thoſe roots which had been cultivated by the plough, were ſo
" much larger than the other, that the crop of one acre weighed a
" ton and a half more than that of an acre in the other huſbandry.

" When the turneps are ſown in drills, they will require to be
" hoed by hand, to ſeparate and cut out the plants, where they are
" too near together in the rows; as alſo to cut up the weeds between
" the plants, where the plough cannot reach them. If this is care-
" fully performed, the plowing of the intervals will encourage the
" growth of the roots, by thus ſtirring of the ground, and make it
" much better prepared for the crop of barley, or whatever elſe is
" ſown the following ſpring. This method of culture may be ſup-
" poſed to be more expenſive than that commonly practiſed, by thoſe
" unacquainted with it: but thoſe who have made trials of both,
" find the horſe-hoeing to be much the cheapeſt, and by far the
" beſt: for the country people who are employed in hand-hoeing
" of turneps, are very apt to hurry over their work, ſo that half the
" weeds are left growing, and the plants are ſeldom ſingled out ſo
" well as they ſhould be; nor are they curious enough to diſtinguiſh
" the charlock (which is one of the moſt common weeds in arable
" land) from the turneps*; ſo that about the middle of September,
" it is very common to ſee the fields of turneps full of the yellow
" flowers of the charlock. Now, in the horſe-hoeing, all the weeds
" in the intervals will be entirely deſtroyed; ſo that if a few plants in
" the rows of turneps ſhould be overlooked, they may be eaſily
" drawn when they appear viſible; and by this method the land
" will be ſooner and better cleared from weeds.

" The greateſt evil which attends a crop of turneps, is that of
" their being deſtroyed by the fly, which uſually happens ſoon after
" the plants come above ground, or while they are in the ſeed leaf;
" for after they have put out their rough leaves pretty ſtrong, they
" will be paſt this danger. This is always in dry weather: ſo that
" if there happens rain when the turneps come up, they will grow
" ſo faſt as to be in a few days out of danger from the fly; and it
" hath been found, that thoſe which have been ſown in drills, have
" eſcaped the fly much better than thoſe ſown in broad-caſt: but if
" ſoot is ſown along the ſurface of each drill, it will be of great ſer-

* See charlock in the article Weeds, p. 109.

"vice to keep off the fly, and a ſmall quantity of it will be ſufficient
"for a large field, where the drills only are to be covered.

"Another danger of the crop's being deſtroyed, is from the caterpillars; which very often attack them when they are grown ſo large as to have ſix or eight leaves on a plant. The ſureſt method of deſtroying theſe inſects is to turn a large parcel of hungry poultry early in the morning into the field: they will ſoon devour the inſects, and clear the turneps. To this evil, the turneps which are ſown in drills, are not ſo much expoſed: for as the ground between the rows will be kept ſtirred, the plants will be kept growing, ſo will be leſs in danger of ſuffering from theſe inſects.

"When the ground is ſtirred in every part" (as in the new huſbandry,) "one plowing will be ſufficient after the turneps are eaten, for the ſowing of barley, or any other crop: ſo that there will be an advantage in this, when the turneps are kept late on the ground, as will often be the caſe, eſpecially when they are cultivated for feeding of ewes; becauſe it is often the middle of April before the ground will be cleared; for the late feed in the ſpring, before the natural graſs comes up, is the moſt wanted, where number of ſheep or ewes are maintained; and one acre of turneps will afford more feed than fifty acres of the beſt paſture at that ſeaſon.

"In Norfolk, and ſome other countries, they cultivate great quantities of turneps for feeding of black cattle, which turn to great advantage to their farms; for thereby they procure a good dreſſing for their land; ſo that they have extraordinary good crops of barley upon thoſe lands, which would not have been worth the plowing, if it had not been thus huſbanded.

"There have been many receipts for preventing the fly taking turneps, but few of them deſerve notice: therefore I ſhall only mention two or three which I have ſeen tried with ſucceſs. The firſt was ſteeping the ſeeds in water with flower of brimſtone mixed, ſo as to make it ſtrong of the brimſtone: another was ſteeping it in water with a quantity of the juice of horſe-aloes mixed: both of which have been found of uſe. The ſowing of ſoot, or tobacco-duſt over the young plants, as ſoon as they appear above ground, has alſo been found very ſerviceable: in ſhort, whatever will add vigour to the young plants, will prevent their being deſtroyed by the fly; for theſe never attack them, till they are ſtinted in their growth."

A gentleman, remarkable, among many other good qualities, for ſeveral excellent improvements which he has made in agriculture, tried with ſucceſs the following experiment, to preſerve turneps from the fly, and the better to ſecure their growth. He ſowed the ſeed in a nurſery, where there was leaſt danger of ſlugs or the fly, and where they might eaſily be watered in caſe of great drought, to make them grow the quicker. They remained in this nurſery, till they were large enough to be tranſplanted. By this means, he gained ſome weeks longer, to perfect his fallow, or give a thorough plowing to ground which had borne a crop that ſeaſon. He tranſplanted his turneps into the field, and by planting them regularly a foot aſunder every way, greatly leſſened the expence of hoeing; their regularity making it very eaſy to deſtroy the weeds from time to time, as they appeared. If the ſeaſon is dry, they may be carried from the nurſery to the field, in veſſels full of very moiſt earth, as hereafter adviſed by M. de Chateau-vieux, in his directions for tranſplanting luſerne.

CHAP. VII.

Of FLAX *and* HEMP.

FLAX and Hemp require a rich ſoil, well manured, and brought to a fine tilth, and kept as clear from weeds as poſſibly can be. Theſe plants are of infinite uſe, and may be cultivated to very great advantage.

When they are raiſed in the fields after the uſual method, they ſeldom grow very high, nor do their ſtalks branch out much: but when they are allowed more room, they will riſe much higher, and branch out more, eſpecially towards the top. The time for ſowing both theſe plants is the ſpring. Both of them are ſo great impoveriſhers of the ground, that it requires dunging after each year's crop; nor ſhould either of them be ſown two years together upon the ſame land, in the old huſbandry. The fenny parts of Lincolnſhire, and of the iſle of Ely, are the moſt remarkable places in England for the culture of theſe plants. Betwixt two and three buſhels of ſeed is the uſual allowance for an acre of land ſown in broad-caſt: but Mr. Miller ſays he has found it, from many repeated experiments, much better to ſow the ſeeds in drills, and when the plants are come up, to hoe them, in the ſame manner as is practiſed for turneps, leaving the plants of flax at about ten inches diſtance from each other,

other, and thoſe of hemp a foot or ſixteen inches a-part. Great care ſhould be taken to deſtroy all the weeds, which twice hoeing in dry weather will effect, and be ſufficient culture till the plants are ripe.

Flax begins to ripen towards the latter end of Auguſt, when care muſt be taken not to let it grow over ripe. It ſhould therefore be pulled up as ſoon as the heads begin to grow brown and hang downwards; otherwiſe the ſeeds will ſoon ſcatter and be loſt. If the flax is pulled when it firſt begins to flower, it will be whiter than when it ſtands till the ſeed is ripe; but then the ſeed will be loſt, and the thread made of it, tho' of a fairer colour, will not be ſo ſtrong as when the plants are ſuffered to ſtand longer.

There are two ſeaſons for pulling hemp. The firſt is uſually about the middle of Auguſt, when they begin to pull what is called the fimble hemp, which is the male plants: but Mr. Miller thinks it would be much better to defer this a fortnight or three weeks longer, until the male plants have fully ſhed their duſt, without which, the ſeeds will prove abortive, produce nothing if ſown the next year, nor yield any oil.

The ſecond pulling is a little after Michaelmas, when the ſeeds are ripe. This is commonly called Karle Hemp, and is the female plants, which were left at the time when the male were pulled.

An acre of hemp, on a rich ſoil, will produce, in the common huſbandry, near three quarters of ſeed, which, together with the unwrought hemp, is worth from ſix to eight pounds. The quantity of flax ſeed annually imported into Scotland and Ireland, from the Eaſt country, and particularly from Riga, amounts to many thouſand pounds ſterling, which might be ſaved the public, by properly encouraging the culture of theſe plants in the northern colonies of America.

The quantity of food which flax and hemp require, ſeems to ſecure their ſucceſs in the new huſbandry. M. Duhamel gives us the following experiments made on them in that method, as a ſpecimen of what may be hereafter expected.

M. de Chateau-vieux divided a field into 12 beds, 53 toiſes and two feet long, and ſeven feet wide. The middle of each bed was raiſed high, that there might be a greater depth of mould under the plants. The ſoil was ſtrong; but had been ſo thoroughly pulveriſed by plowing, that it was as fine as ſand.

On

On the twentieth of March 1753, he sowed six of these beds with the drill-plough, planting six rows of flax in each bed, and using for that purpose nine pounds of seed.

The plants came up well, and grew thick: but a frost which happened in April damaged many of them.

The twenty-sixth of April, he sowed the six other beds in the same manner, with 13 pounds of hemp-seed, which likewise came up thick.

The alleys had been horse-hoed but once, and the plants came on greatly, when they were beat down by hail, which did them considerable damage, tho' they afterwards recovered themselves in some degree. The flax was pulled up the first of August, and the hemp the eighteenth.

This accident prevented knowing what the produce of the crop might otherwise have been. The plants were taller than usual, and had many more roots; by which one may judge that they would have yielded a greater quantity of flax and hemp, than in the common way.

Another misfortune which attended them was, that they were very badly steeped: but yet one might easily perceive that their threads will be a great deal stronger by this culture, than when they are raised according to the old method.

'Tis of very great importance, at the same time that the quantity of the flax is increased, to be able to add to its strength. The linnen made of it, will be better and last longer, and consequently prove a considerable saving.

The superior quality of the hemp employed in the cordage of ships, is an object of the utmost importance; for it must be of very great advantage to have rope of a less diameter be as strong as those of a larger size. With such, the same work may be performed more easily and more readily, and perhaps with fewer hands: probably too, the ropes will be more durable. But all these motives of œconomy are still vastly inferior to the inestimable advantage of saving the ships, their cargoes, and their crews, which often depends on the strength of their sails and cables. I have only barely mentioned these great objects, to invite all who have the public good at heart, to make experiments which may tend to the utmost improvement of the culture of these plants. How pleasing is the reflection, that whilst we are providing greater plenty of food for the sustenance of men, we may likewise contribute to the preservation of lives so useful to the community!

M. de

M. de Chateau-vieux obſerves that flax does not ſucceed ſo well in other years, as when there are frequent ſhowers; and that the year 1754, being very dry, proved extremely unfavourable to it. The flax was very ſhort; but that defect was in ſome meaſure compenſated by the abundance of the ſeed, and the fineneſs of the bark of the plant, which was alſo ſtronger than uſual.

Hemp ſucceeded better: it grew this year five or ſix feet high: its ſtalks were large, and the bark very thick and ſtrong. The ground ſown with it now, was that on which it was uſually ſown, and never had produced ſo great a quantity.

In an experiment made in Lower Normandy in 1754, the hemp was ſhort, but extremely fruitful in ſeed, eſpecially the two outer rows, which had profited moſt by the hoeings. The middle row was ſhorter than the other two, and yielded leſs ſeed. The frequent rains in the ſpring, prevented the ground's being ſo well prepared as it ſhould have been, becauſe it was too wet: but, upon the whole, it ſeemed pretty evident, that hemp cannot be raiſed to its proper height without the aſſiſtance of ſome dung.

M. Aimen, from 40 plants of female hemp (commonly called male) raiſed in the common way, and which might be deemed fine ones, had but half a pound of ſeed, and the ſtalks were not more than a quarter of an inch in diameter near the root.

A ſingle plant of the ſame kind, which grew by itſelf, the earth being kept in a looſe ſtate round it, yielded ſeven pounds and an half of ſeed. It had many branches, and the ſtalk was three inches in diameter near the root. 'Tis true the hemp was coarſe and woody, and the fibres were interrupted where the branches grew. Thoſe who raiſe this plant only for the oil of its ſeed, frequently ſow it at proper diſtances between their kidney beans and other leguminous plants, and it never fails to yield better ſeed than that which is raiſed in the common way.

CHAP. VIII. SECT. I.

Of the culture of Sainfoin.

THE French call this plant *ſainfoin*, *ſain* in their language ſignifying wholeſome, and *foin* hay, becauſe they obſerve that it agrees exceedingly well with all kinds of cattle. We improperly call it *ſaint foyn*, and frequently *French graſs*, becauſe we owe our firſt knowledge of it to the French.

If this plant is cultivated according to the new hufbandry, its ftalks will grow to the length of five feet; and, according to Mr. Tull, one acre of fainfoin will yield as much grafs as 30 or 40 acres of common grafs.

This great fruitfulnefs of fainfoin, is owing to the vaft quantity of its roots. Its tap-root pierces fometimes fifteen or twenty feet deep into the earth, and fends forth many lateral branches, which extend a great way, efpecially towards the furface of a good foil.

It is wrong to think, as many do, that fainfoin will not fucceed if there is not at a certain depth a bed of gravel, ftone, or chalk, to ftop the progrefs of its roots. On the contrary, the deeper the earth is, the more its roots extend, and the ftronger and more flourifhing is the plant.

As fome of its feed will frequently not grow, a fmall quantity fhould always be fown firft, to try it, as has been directed in regard to wheat.

This plant ought not to be fown above half an inch deep, efpecially in ftiff lands: for the heads of thefe feeds are fo large, and their necks fo weak, that if they lie much more than half an inch deep, they are not able to rife through the incumbent mould.

As fainfoin yields but an inconfiderable produce the firft years, the farmer, in order to make the more of his land, often fows barley, oats, clover, &c. with it. The barley and oats remaining but a fhort time on the earth, damage the fainfoin but little: but clover, and other perennial plants, do it great hurt.

In dry years, it frequently happens that when the barley or oats are mowed, no fainfoin yet appears. But on examining nearly, we generally perceive white threads, which fhew that the fainfoin has fprouted; but its leaves, which were very fmall, have been cut off by the mowers.

If the other feeds fown with the fainfoin, come up thick, and grow a-pace, and efpecially if they are lodged, the fainfoin is generally choaked. This feldom happens if it is fown with the drill-plough: for as it is then drilled by itfelf, in feparate rows, it is lefs in danger of being choaked by any other plants. It muft however be owned that it always does beft when fown quite alone.

When Mr. Tull began to cultivate fainfoin according to his method, he fowed two gallons of feed to an acre. But almoft all the feed of an acre or two of ground chancing to perifh by its being fown too late, he was agreeably furprifed at the end of three years, to fee fome ſome plants of ſainfoin of an extraordinary ſize diſperſed here and there, ſo that there were about four plants in a yard ſquare. This part of his field yielded him double the quantity of graſs that the reſt of it did, where the ſeed had not periſhed, and where the ſainfoin was much better than in lands which had been ſown in the common way.

Mr. Tull concludes from thence, that it is moſt profitable to ſow ſainfoin thin, that the roots of one plant may not hurt thoſe of another: and he thinks that they deceive themſelves who ſow their ſainfoin very thick in hopes of reaping a more plentiful crop: becauſe that by ſo doing they reduce their ſainfoin to the ſame condition it is in on the hills of Calebria, near Croto, where it grows naturally without any culture, but ſo low and ſtinted, that one would almoſt wonder what could induce any one to think of cultivating ſo unpromiſing a plant as it there ſeems to be.

Mr. Tull ſupports his opinion by an obſervation which it may not be improper to mention. He ſays that a field of ſainfoin joining to a piece of land which they were plowing up for corn, was greatly damaged by the plough, which, breaking in upon the ſainfoin, tore up ſeveral plants: but that this part of the field yielded afterwards more graſs than any other.

Mr. Tull thinks a gallon of good ſeed enough for an acre of land. But this ſeed ſhould be ſo diſtributed, that all the plants may be at equal diſtances. This cannot be done but with the drill-plough. There is no fear of diminiſhing the crop, by leſſening the number of the plants; for one plant well cultivated will yield above half a pound of hay; and conſequently if only 112 plants grow upon a ſquare perch, and yield one with another only a quarter of a pound each, they will produce after the rate of two tun to an acre. One would not expect ſo conſiderable a return while the plants are yet ſmall and young: they do not cover the ground, and the field looks as if the greateſt part of it lay waſte: but when they have attained their full growth, they cover the whole ſurface. Another advantage ariſing from the new huſbandry is, that if the ſainfoin has been ſown early, it yields a crop the ſecond year, equal to the third year's crop of that which is ſown in the common way.

Mr. Tull draws theſe concluſions from his experiments. 1. When ſainfoin is ſown with a deſign to cultivate it with the horſe-hoe, the beſt way is to ſow it in two parallel rows, eight inches diſtant from each other, and to make the alleys forty inches wide; ſo that from the

the middle of one furrow, to the middle of another, ſhall be four feet.

2. If ſainfoin is ſown with an intention only to hand-hoe it, there ſhould be a ſpace of ſixteen inches between each row, and the plants in the rows ſhould be at leaſt eight inches aſunder.

3. When ſainfoin is ſown without any intention of hoeing it, the beſt way is to drill the rows eight inches aſunder, with no greater quantity of ſeed, than when they are at ſixteen inches diſtance: for each plant ought to have a ſufficient ſpace round it, to extend its roots in, and draw its neceſſary nouriſhment from, without hurting its neighbouring plants.

Sainfoin thrives beſt in rich, dry, light ſoils, and eſpecially if there is a conſiderable depth of mould. In marſhy grounds, or in lands which retain the water, the roots are chilled, and the plant ſoon periſhes.

Tho' ſainfoin is a ſtrong plant, the ground where it is ſown ought to be in very fine tilth: for as it immediately ſhoots out a great number of roots as ſoon as it ſprouts, the mould ought to be looſe, and the ſtaple as deep as poſſible.

Sainfoin may be ſowed at any time: but when it is ſown in autumn, the young plants are in danger of being hurt by froſts: if it is ſown in ſummer, it frequently happens that the ſeed remains long in the earth without ſprouting; or if it riſes, the drought, uſual at that ſeaſon, ſtints the young plants. The ſpring is therefore the moſt proper ſeaſon for ſowing it, when there is no longer any danger of hard froſts.

By means of the drill-plough, the ſeed of the ſainfoin is dropt into channels which this inſtrument makes, and is at the ſame time covered with the proper depth of earth.

It will not be neceſſary to horſe-hoe the alleys between the beds of ſainfoin, ſo often as between thoſe of corn. It will be ſufficient to horſe-hoe the alternate alleys once a year. By this means, one half of the alleys will be reſted each year, on which the hay may be made. Thus the expence will be but trifling, and the ſainfoin may laſt thirty years on the ſame ground, which, by this frequent ſtirring, will be the better prepared to receive other grains after the ſainfoin.

Sainfoin deſerves the utmoſt attention of the farmer, as being certainly one of the moſt profitable plants he can cultivate. It will do on almoſt any land; and though it ſucceeds beſt in good ſoils, yet it it will grow even on dry barren ſpots, where ſcarce any other graſs can live.

Sainfoin has this farther advantage, that it may be mowed at different degrees of ripeneſs, with nearly the ſame profit.

1. It may be mowed before it is in bloom. It is then an admirable food for horned cattle; and when cut thus early, it yields a ſecond crop which makes ample amends for what was loſt by not letting the firſt come to its full growth.

2. If the weather be rainy, the ſainfoin may be left ſtanding till it is in bloom. It is ſtill excellent fodder for cows. But care muſt be taken in making it into hay, that the flowers do not drop off, which they are very apt to do: for cattle are ſo fond of the flowers, that theſe often induce them to eat the reſt of the plant.

3. If the rain continues, the ſainfoin may continue ſtanding till ſome of its ſeeds are formed. The crop will then be more plentiful: not only becauſe it will have attained its full growth, but likewiſe becauſe its leaves, being more ſubſtantial, diminiſh leſs in drying. 'Tis true, it is not then ſo pleaſant for fodder: but horſes eat it readily, becauſe they love to feel between their teeth the ſeeds which now begin to be formed.

Mr. Tull ſays this fodder is ſo excellent, that horſes need no oats when they are fed with it. He affirms that he kept a team of horſes with it a whole year in good plight, without giving them any oats, tho' they were worked hard all the time. He adds, that he fattened ſheep with it, in leſs time than others which were fed with corn. But the hay of this plant can never be ſo good as when it is cultivated with the horſe-hoe: for in the comon huſbandry, it bloſſoms almoſt as ſoon as it is out of the ground.

4. If the ſeaſon continues rainy, it would be more adviſeable ſtill to let the ſainfoin ſtand, than to run the riſque of having it rot upon the ground: for then the ſeed will ripen, and nearly make up the loſs of the fodder: not only becauſe that ſeed may be carried to market; but likewiſe becauſe two buſhels of it will go as far in feeding horſes, as three buſhels of oats; and cattle in general, as well as poultry, are extremely fond of it.

Even the ſainfoin that has yielded its ſeed, may be cut down and dried, and, in times of ſcarcity of fodder, will be better food for horſes and large cattle, than the coarſe hay of water-meadows, or any kind of ſtraw.

The manner of making ſainfoin hay, is as follows.

In

In a day or two after the ſainfoin has been mowed, it will be dry on the upper ſide, if the weather is good. The ſwarths, or mowed rows, ſhould then be turned, not ſingly, but two and two together: for by thus turning them in pairs, there is a double ſpace of ground betwixt pair and pair, which needs but once raking: whereas, if the ſwarths were turned ſingly, that is, all the ſame way, the ground would require as much raking again.

As ſoon as both ſides of the ſwarths are dry from rain and dew, they ſhould be made up into little cocks, the ſame day they are turned, if poſſible: for when it is in cock, a leſs part of it will be expoſed to the injuries of the night, than when it lies ſcattered upon the field. The ſun and dew would exhauſt almoſt all its juices, in this laſt caſe, in leſs than a week's time.

Theſe little cocks of ſainfoin may be ſafely made into larger ones, without waiting for its being ſo thoroughly dry as common hay is required to be: becauſe common hay, by ſinking down cloſer, excludes the air neceſſary for keeping it ſweet, ſo that if the weather prevents its being frequently mov'd and open'd, it will ferment, turn yellow, and be ſpoil'd; whereas ſainfoin, by the leſs flexibility of its ſtalks, admitting the air more freely, will remain much longer without any danger of fermenting.

Sainfoin hay is never better than when it has been dried by the wind alone, without the aſſiſtance of the ſun. A little rain, or a miſt, which will turn common hay, clover, and even luſerne black, will do no hurt to ſainfoin, which is not really ſpoil'd, till it rots upon the field.

If the weather threatens rain, and the ſainfoin is not yet dry, it may be laid up in cocks, without fear of its heating, provided a large baſket, or buſhy faggot be ſet up in the middle of each cock, where it will ſerve for a vent hole, through which the ſuperfluous moiſture of the hay will tranſpire.

As ſoon as all danger of its heating is over, theſe cocks ſhould be made into ricks, and thatched; as indeed all ricks of ſainfoin ought to be, though the hay be ever ſo dry in the cocks.

That which is laid up quite dry, will come out of the rick of a green colour: that which has heated much in the rick, will have a brown colour.

It requires ſome experience to know the moſt proper degree of ripeneſs at which the ſeeded ſainfoin ought to be cut; for the ſeed is never all ripe together; ſome ears bloſſom before others: every ear begins bloſſoming at the lower part of it, and ſo continues gradually to do upward for many days; and before the flower is gone off the top, the bottom of the ear has almoſt filled the ſeeds that grow there; ſo that if we ſhould defer cutting till the top ſeeds are quite ripe, the lower, which are the beſt, would ſhed, and be loſt. The beſt time to cut it, is when the greateſt part of the ſeed is well filled, the firſt blown ripe, and the laſt blown beginning to be full. The unripe ſeeds will ripen after cutting, and be, in all reſpects, as good as thoſe that were ripe before. Some, for want of obſerving this, have ſuffered this ſeed to ſtand till it was all ripe, and then it has ſhed, and been loſt in cutting.

Sainfoin ſhould never be cut in the heat of the day, while the ſun ſhines out; for then much, even of the unripe ſeed, will ſhed in mowing. The right time for this work, is in the morning or the evening, when the dew has rendered the plants ſupple.

If the weather is fine and clear, the ſainfoin will ſoon dry ſufficiently in the ſwarths, without turning them: but if any rain has fallen, and there is a neceſſity for turning them, it ſhould be done very gently, whilſt they are moiſt, and not two together, as in the other hay of ſainfoin before it has ſeeded. If the ſwarths are turned with the handle of the rake, 'tis beſt to raiſe up the ear-ſides firſt, and let the ſtub-ſide reſt on the ground in turning: but if it is done with the teeth of the rake, let the ſtub-ſide be lifted up, and the ears reſted on the earth.

If ſainfoin be cocked at all*, the ſooner it is done, the better; becauſe, if the ſwarths are dry, much of the ſeed will be loſt in ſeparating them, the ears being entangled together. When moiſt, the ſeed ſticks faſt to the ear; but, when dry, it drops out with the leaſt touch or ſhaking.

There are two ways of threſhing it: the one in field, the other in the barn. The firſt cannot be done but in very fine weather, and while the ſun ſhines in the middle of the day. The beſt manner of doing this, is to have a large ſheet pegg'd down to the ground, for two men with their flails to threſh on, whilſt two other men bring them freſh ſupplies in a ſmall ſheet, and two others clear away the hay that is threſhed. The ſeed is emptied out of the great ſheet, and

* Sometimes it is threſhed in the field, without being cocked. In that caſe, the ſwarths are only juſt ſeparated, in the dew of the morning, into parcels of about two feet each, by which means it is ſooner dried, than when it lies thicker, as it muſt do, if made into cocks.

riddled

riddled through a large ſieve, to ſeparate it from the chaff and broken ſtalks, after which it is put into ſacks and carried into the barn to be winnowed. Care ſhould be taken not to let the hay be wet, becauſe it would be ſpoiled.

A very important, and at the ſame time very difficult article, is the keeping of the ſeed which is threſhed in the field, without having ever been wetted. If it be immediately winnowed, and only a little of it laid amidſt a great heap, or put into a ſack, it will, in a few days, ferment to ſuch a degree, that the greateſt part of it will loſe its vegetative quality. During that fermentation, it will be very hot, and ſmell ſour. Spreading it upon a barn-floor, only ſeven or eight inches thick, will anſwer no end, unleſs it be frequently and regularly turned both day and night, until the heating is over: but even this will not make its colour keep ſo bright as that which is well houſed, well dried, and threſhed in the winter. This laſt, laid up unthreſhed, will keep without any danger of ſpoiling, becauſe it does not lie cloſe enough to heat. The beſt way to preſerve the ſeed threſhed in the field, is to lay a layer of ſtraw upon a barn floor, and upon that a thin layer of ſeed, then another layer of ſtraw, and another layer of ſeed, and ſo on, alternately. By this means, the ſeed, mixing with the ſtraw, will be kept cool, and come out in the ſpring with as green a colour as when it was put in.

The greateſt part of the ſainfoin that is ſown, is ſpoiled by being indiſcreetly fed by cattle. Mr. Tull is againſt feeding it at all the firſt and ſecond year, or any other year in the ſpring. He ſays he has recovered worn-out pieces of ſainfoin, by plowing them in alleys three feet wide, and leaving beds of ſainfoin of the ſame breadth alternately between them. The plants, by extending their roots in theſe new plowed alleys, have recovered their vigor, and yielded good crops of hay. He adds, that ſainfoin is obſerved to enrich whatever ground it is planted on, even tho' a crop be taken off it yearly.

This is confirmed by the author of the *New Syſtem of agriculture*, who ſays; "There is a foreign graſs much properer for light "lands, than clover: 'tis generally known by the name of *St. Foyne*; "but that which I have ſeen in ſeveral parts of Berkſhire, Wiltſhire, "Somerſetſhire, and many other counties, is a baſtard ſort, and much "inferior to the true *St. Foyne*, which may be had, very reaſonably, "from Dunkirk, or Calais, and is yearly imported in great quantities, and ſold in the ſeed-ſhops at London and elſewhere.——As "to the time of letting it grow, that may, if you pleaſe, be five

" years,* for ſo long it will continue in its prime perfection; and, " running into a large knotty root, does ſo enrich the ground it " grows on, that, after it has borne *ſaint foyne* five years, it will " afford three excellent crops of what corn you pleaſe; and ſo im- " prove itſelf, by alternate burthens of graſs and grain, till it arrives " at the utmoſt perfection which land is capable of reaching.—— " Nothing is ſo ſweet, nothing ſo innocent, nothing ſo nouriſhing, " as this *ſaint foyne*; but, above all, it is obſerv'd to increaſe milk, " in quantity, and quality, beyond any graſs, yet known, in the " whole world."

We ſhall now give the ſubſtance of a few experiments on the culture of this plant, as related by M. Duhamel.

SECT. II.

Experiments on Sainfoin.

IN 1754, M. Eyma planted luſerne, ſainfoin, and clover, the plants 16 inches aſunder one way, and 8 feet the other. They yielded him an immenſe increaſe. The alleys were horſe-hoed after every cutting.

In 1755, a field of 888 ſquare toiſes planted with ſainfoin according to the new huſbandry, produced him ten thouſand weight of dry hay. M. de Chateau-vieux had 15340 pounds of luſerne off one arpent, which he cut five times: but M. Eyma thinks that 14445 pounds, Geneva weight, of ſainfoin, which he had at one cutting, is a greater crop than M. de Chateau-vieux's luſerne; beſides the after crop, which indeed was but inconſiderable on account of the drought of the ſeaſon. He ſays he cuts his ſainfoin three times in good years, and that the two laſt cuttings produce nearly as much as the firſt: but he allows that ſuch years are not to be expected often.

M. Eyma doubts whether the preference be due to ſainfoin or to luſerne: but he is confident that either of them, properly cultivated, will produce ſurpriſing crops.

He thinks that one row of ſainfoin, or luſerne, planted in the middle of a bed three feet wide, will profit more by the different

* Tho' this author limits the prime perfection of ſainfoin to five years, in the common huſbandry; it will continue equally flouriſhing a much longer time, when cultivated according to the new method.

hoeings, and consequently produce more grass, than double or triple rows, tho' these last are planted on larger beds; because the single rows have the earth loosened on each side.

M. Diancourt sowed sainfoin, each plant of which, in 1753, had a head of two feet diameter. They throve so well that, in 1755, one plant, and that not the largest in the field, produced 23 ounces of hay.

CHAP. IX. SECT. I.

Of the culture of Luserne.

LUSERNE, or medick, is so generally known, that a particular description of it would be needless. It bears a blue, or rather purplish blossom, which leaves a pod like a screw, in which are the seeds, about the bigness of broad clover, but longer, and more of the kidney-shape.

When the stalks of luserne are cut, instead of withering, as sainfoin does, they spring out again from the stubs, immediately below where the scythe parted them, and are thereby sooner replenished with new shoots, than sainfoin, which shoots only from the root.

Luserne grows very quick, and strong. A single plant of it, if let grow without cutting, will form a kind of shrub.

It will not, like sainfoin, thrive in any soil: That which it delights most in, is a rich, deep, mellow earth, not over dry. It cannot endure cold rains; and therefore does not succeed well in Switzerland, tho' the inhabitants do all they can to cultivate it, from a persuasion of its being a sovereign remedy for the diseases of horses: it grows but poorly neither in the western parts of France: but in the south of that kingdom, the same field is sometimes mowed five or six times a year, and yields a prodigious quantity of excellent fodder.

" This plant, " says Mr. Miller," hath not yet found so good " reception in our country as could be wished, nor is it cultivated " in any considerable quantity, tho' it is evident it will succeed well " in England, being extremely hardy, and resisting the severest cold " of our climate. As a proof of this, continues he, I must beg " leave to mention, that the seeds which have happened to be scat- " tered upon the ground in autumn, have come up, and the plants

" have

"have endured the cold of a ſevere winter, and made very ſtrong "plants.

"About the year 1650, the ſeeds of this plant were brought over "from France, and ſown in England: but whether for want of "ſkill in its culture, whereby it did not ſucceed, or that the people "were ſo fond of going on in their old beaten road, as not to try the "experiment whether it would ſucceed here or not, was the occa-"ſion of its being entirely neglected in England, I cannot ſay: but "it is very certain that it was neglected many years, ſo as to be al-"moſt forgotten. However, I hope, before I quit this article, to "give ſuch directions for its culture, as will encourage the people of "England to make farther trial of this valuable plant, which grows "in the greateſt heat, and alſo in very cold countries, with this "difference only, that in very hot countries, ſuch as the Spaniſh "Weſt-Indies, *&c.* where it is the chief fodder for their cattle at "this time, they cut it every week; whereas in cold countries it is "ſeldom cut oftener than three or four times a year. And it is very "likely, that this plant will be of great ſervice to the inhabitants of "Barbadoes, Jamaica, and the other hot iſlands in the Weſt Indies, "where one of the greateſt things they want is fodder for their "cattle; ſince by the account given of this plant by F. Feuillé, it "thrives exceedingly in the Spaniſh Weſt Indies, particularly about "Lima, where they cut it every week, and bring it into the market "to ſell, and is there the only fodder cultivated.

"It is alſo very common in Languedoc, Provence, and Dauphiné, "and all over the banks of the Rhone, where it produces abundant-"ly, and may be mowed five or ſix times in a year. Horſes, mules, "oxen, and other domeſtick cattle, love it exceedingly; but above "all when it is green, if they are permitted to feed on it, and eſpe-"cially the black cattle, which will feed very kindly upon the dried "plant, the exceſs of which is, by many people, thought to be very "dangerous: but it is ſaid to be exceeding good for milch cattle, to "promote their quantity of milk; and is alſo ſaid to agree with "horſes the beſt of all, tho' ſheep, goats, and moſt other cattle, will "feed upon it, eſpecially when young.

"The directions given by all thoſe who have written of the "culture of this plant are very imperfect*; for moſt of them order

* We flatter ourſelves that M. de Chateau-vieux's directions, and his experiments, will appear in a different light.

" the mixing of this feed with oats or barley (as is practifed for clo-
" ver;) but in this way it feldom comes up well; and, if it does,
" it will draw up fo weak by growing amongft the corn, as not
" to be recovered under a whole year, if ever it can be brought to
" its ufual ftrength again.

" Others have directed it to be fown upon a low rich moift foil;
" which is found to be the worft, next to a clay, of any for this
" plant; in both which the roots will rot in winter, and in a year or
" two the whole crop will be deftroyed.

" But the foil in which this plant is found to fucceed beft in this
" country is, a light, dry, loofe, fandy land, which fhould be well
" plowed and dreffed, and the roots of all noxious weeds, fuch as
" couch grafs, *&c.* deftroyed; otherwife thefe will over-grow the
" plants while young, and prevent their progrefs.

" The beft time to fow the feed is about the middle of April,
" when the weather is fettled and fair: for if you fow it when the
" ground is very wet, or in a rainy feafon, the feeds will burft and
" come to nothing (as is often the cafe with feveral of the legumi-
" nous plants); therefore you fhould always obferve to fow it in a
" dry feafon, and if there happens fome rain in about a week or
" ten days after it is fown, the plants will foon appear above
" ground.

" But the method I would direct for fowing thefe feeds, is as
" follows. After having well plowed and harrowed the land very
" fine, you fhould make a drill quite a-crofs the ground almoft half
" an inch deep, into which the feeds fhould be fcattered very thin:
" then cover them over a quarter of an inch thick, or fomewhat
" more, with the earth: then proceed to make another drill, about
" a foot and a half from the former, fowing the feeds therein in the
" fame manner as before, and fo proceed through the whole fpot of
" ground, allowing the fame diftance between row and row, and
" fcatter the feeds very thin in the drills. In this manner, an acre
" of land will require about fix pounds of feed: for when it is fown
" thicker, if the feed grows well, the plants will be fo clofe as to
" fpoil each other in a year or two, the heads of them growing to a
" confiderable fize, as will alfo the roots, provided they have room.
" I have meafured the crown of one root, which was in my poffef-
" fion, eighteen inches diameter; from which I cut near four hun-
" dred fhoots at one time, which is an extraordinary increafe, and
" this upon a poor dry gravelly foil, which had not been dunged for
" many

" many years, but the root was at leaſt ten years old; ſo that if
" this crop be well cultivated, it will continue many years *, and
" be equally good as when it was firſt ſown: for the roots gene-
" rally run down very deep in the ground, provided the ſoil be
" dry; and although they ſhould meet a hard gravel a foot below
" the ſurface, yet their roots would penetrate it, and make their
" way downward, as I have experienced, having taken up ſome of
" them, which were above a yard in length, and had run two feet
" into a rock of gravel, ſo hard as not to be looſened without mat-
" tocks and crows of iron, and that with much difficulty.

" The reaſon for directing this ſeed to be ſown in rows is, that
" the plants may have room to grow; and for the better ſtirring
" the ground between them, to deſtroy the weeds, and encourage
" the growth of the plants, which may be very eaſily effected with
" a Dutch hoe, juſt after the cutting the crop each time, which
" will cauſe the plants to ſhoot again in a very little time, and be
" much ſtronger than in ſuch places where the ground cannot be
" ſtirred: but when the plants firſt come up, the ground between
" ſhould be hoed with a common hoe; and if in doing of this you
" cut up the plants where they are too thick, it will cauſe the re-
" maining to be much ſtronger. This hoeing ſhould be repeated
" two or three times while the plants are young, according as the
" weeds are produced, obſerving always to do it in dry weather,
" that the weeds may the better be deſtroyed; for if it be done in
" moiſt weather, they will root and grow again.

" With this management, the plants will grow to the height of
" two feet, or more, by the beginning of Auguſt, when the flow-
" ers will begin to appear, at which time the luſerne ſhould be
" cut, obſerving to do it in a dry ſeaſon, if it is to be made hay,
" and keep it often turned, that it may ſoon dry, and be carried
" off the ground; for if it lie long upon the roots, it will prevent
" their ſhooting again. After the crop is taken off, you ſhould ſtir
" the ground between the rows with a hoe, to kill the weeds, and
" looſen the ſurface, which will cauſe the plants to ſhoot out again
" in a ſhort time, ſo that by the beginning of September there will
" be ſhoots four or five inches high, when you may turn in ſheep
" upon

* M. Duhamel likewiſe ſays, that it will continue a long time on the ſame ground, if care be taken that the natural graſs or weeds do not choak it; for as ſoon as any other plants come up amongſt luſerne, it decays gradually and dies, ſo that very little of it will remain at the end of a few years.

" upon it to feed it down: nor ſhould the ſhoots be ſuffered to " remain upon the plants, which would decay when the froſty weather comes on, and fall down upon the crown of the roots, and " prevent their ſhooting early the ſucceeding ſpring.

" The beſt way therefore is to feed it until November, when " it will have done ſhooting for that ſeaſon: but it ſhould not be " fed by large cattle the firſt year, becauſe the roots, being young, " would be in danger of being deſtroyed, either by their trampling " upon them, or their pulling them out of the ground: but ſheep " will be of ſervice to the roots by dunging the ground, pro- " vided they do not eat it too cloſe, ſo as to endanger the crown " of the roots.

" The beginning of February, the ground between the rows " ſhould be again ſtirred with the hoe, to encourage them to ſhoot " again: but in doing of this you ſhould be careful not to injure " the crown of the roots, upon which the buds are at that time " very turgid, and ready to puſh. With this management, if the " ſoil be warm, by the middle of March the ſhoots will be five or " ſix inches high, when, if you are in want of fodder, you may " feed it down till a week in April; after which it ſhould be ſuf- " fered to grow for a crop, which will be fit to cut the beginning " of June, when you ſhould obſerve to get it off the ground as " ſoon as poſſible, and ſtir the ground again with the Dutch hoe, " which will forward the plants ſhooting again, ſo that by the mid- " dle, or latter end of July, there will be another crop fit to cut, " which muſt be managed as before; after which it ſhould be fed " down again in autumn: and as the roots by this time will have " taken deep hold in the ground, there will be little danger of hurt- " ing them, if you ſhould turn in larger cattle; but you muſt al- " ways obſerve not to ſuffer them to remain after the roots have " done ſhooting, leſt they ſhould eat down the crown of the roots " below the buds, which would conſiderably damage, if not de- " ſtroy them.

" In this manner you may continue conſtantly to have two crops " to cut, and two feedings upon this plant, and in good ſeaſons " there may be three crops cut, and two feedings, which will be a " great improvement, eſpecially as this plant will grow upon dry " barren ſoils, where graſs will come to little, and be of great uſe " in dry ſummers, when graſs is often burnt up: and as it is an " early plant in the ſpring, ſo it will be of great ſervice when fod-

" der

" der falls ſhort at that ſeaſon, when it will be fit to feed at leaſt a " month before graſs or clover; for I have had this plant eight " inches high by the tenth of March, old ſtyle, at which time " the graſs in the ſame place has ſcarcely been one inch high.

" That cold will not injure this plant, I am fully ſatisfied *; " for in the very cold winter, Anno 1728—9, I had ſome roots of " this plant which were dug up in October, and laid upon the " ground in the open air till the beginning of March, when I " planted them again, and they ſhot out very vigorouſly ſoon af- " ter: nay, even while they lay upon the ground, they ſtruck out " fibres from the under ſide of the roots, and had begun to ſhoot " green from the crown of the roots. But that wet will deſtroy " the roots, I am fully convinced, for I ſowed a little of the ſeed " upon a moiſt ſpot of ground for a trial, which came up very " well, and flouriſhed exceedingly during the ſummer ſeaſon, but " in winter, when the great rains fell, the roots began to rot at bot- " tom, and before the ſpring moſt of them were deſtroyed.

" The beſt places to procure the ſeed from, are Switzerland and " the northern parts of France, which ſucceeds better with us than " that which comes from a more ſouthern climate: but this ſeed " may be ſaved in England in great plenty; in order to which, a " ſmall quantity of the plants ſhould be ſuffered to grow uncut till " the ſeeds are ripe, when it muſt be cut, and laid to dry in an " open barn where the air may freely paſs through: but the ſeed " muſt be defended from the wet; for if it be expoſed thereto, it " will ſhoot while it remains in the pod, whereby it will be ſpoiled. " When it is quite dry, it muſt be threſhed out, and cleanſed from " the huſk, and preſerved in a dry place till the ſeaſon for ſowing " it: and this ſeed ſaved in England is much preferable to any " brought from abroad, as I have ſeveral times experienced, the " plants produced from it having been much ſtronger than thoſe " produed from French, Helvetian, and Turkey ſeeds, which " were ſown at the ſame time, and on the ſame ſoil and ſituation.

" I am inclinable to think that the reaſon of this plant not ſuc- " ceeding, when it has been ſown in England, has either been oc- " caſioned by the ſowing it with corn, with which it will by no

" means

* This is confirmed by M. Duhamel, who ſays that the hard winter in 1709, which killed almoſt all the olive and walnut-trees in France, did no great damage to the luſerne.

" means thrive * (for though the plant be very hardy when grown
" pretty large, yet at its firſt coming up, if it be incommoded by
" any other plants or weeds, it ſeldom does well; therefore it
" ſhould always be ſown by itſelf, and carefully cleared from
" weeds until it has ſtrength, after which it is not eaſily deſtroy-
" ed;) or, perhaps, people have ſown it at a wrong ſeaſon, or in
" wet weather, whereby the ſeeds have rotted, and never come
" up, which hath diſcouraged their attempting it again: but how-
" ever the ſucceſs has been, I dare aver, that if the method of ſow-
" ing or managing of this plant, which is here laid down, be
" duely followed, it will be found to thrive as well as any other
" ſort of fodder now cultivated in England, and will continue much
" longer: for if the ground be duly ſtirred after the cutting each
" crop, and the firſt crop fed, as hath been directed, the plants
" will continue in vigour twenty years, or more, without renew-
" ing, provided they are not permitted to feed, which would weaken
" the roots more than four times cutting would do.

" The hay of this plant ſhould be kept in cloſe barns, it being
" too tender to be kept in reeks open to the air as other hay: but
" it will remain good, if well dried before it be carried in, three
" years. The people abroad reckon an acre of this fodder ſuffici-
" ent to keep three horſes all the year round: and I have been aſ-
" ſured by perſons of undoubted credit, who have cultivated this
" plant in England, that three acres of it have fed ten cart horſes
" from the end of April to the beginning of October, without any
" other food, though they have been conſtantly worked. Indeed
" the beſt uſe that can be made of this graſs is, to cut it, and give
" it green to the cattle. Where this hath been daily practiſed, I
" have obſerved that by the time the field has been cut over, that
" part which was the firſt cut, hath been ready to cut again; ſo
" that there has been a conſtant ſupply in the ſame field, from the
" middle of April to the end of October, when the ſeaſon has con-
" tinued long mild; and when the ſummers have proved ſhowery,
" I have known ſix crops cut in one ſeaſon: but in the dry ſea-
" ſons there will be always three. When the plant begins to flow-
" er, it ſhould then be cut; for if it ſtands longer, the ſtalks will
" grow hard, and the under leaves will decay, and then the cattle
" will not ſo readily eat it. Where there is a quantity of this culti-
" vated,

† M. Duhamel alſo is abſolutely againſt ſowing it with corn, or any other plant.

"vated, ſome of it ſhould be cut before the flowers appear, other-
"wiſe there will be too much to cut within a proper time.

"When this is made into hay, it will require a great deal of making: for as the ſtalks are very ſucculent, it muſt be often turned, and expoſed a fortnight before it will be fit to houſe; for this requires a longer time to make than ſainfoin: therefore, when it is cut, it ſhould be carried to make upon ſome graſs ground; becauſe the earth in the intervals of the rows will waſh up, and mix with the hay in every ſhower of rain; and by carrying it off as ſoon as it is cut, the plants will ſhoot up again ſoon: but it is not ſo profitable for hay, as to cut green for all ſorts of cattle, but eſpecially horſes, which are extremely fond of it; and to them it will anſwer the purpoſe of both hay and corn, and they may be worked at the ſame time juſt as much as when they are fed with corn, or dry food."

To the inſtructions which Mr. Miller has here given for the management of luſerne, we ſhall only add a few remarks of M. Duhamel, and then proceed to the experiments which ſome of his correſpondents, and particularly M. de Chateau-vieux, have made upon the culture of this plant according to the principles of the new huſbandry.

Luſerne, like ſainfoin, may be cut, either before, or while it is in bloom, or when the ſeed is ripe. The only things to be obſerved are,

1. That it makes the beſt fodder, when cut before its lateral ſhoots come out, and conſequently a good while before it bloſſoms.

2. That the earlier it is cut, the ſooner it produces a new crop.

3. That luſerne requires more time to dry it into hay, than ſainfoin: but yet it muſt not be left long upon the field, leſt it ſhould heat, and damage the young ſhoots riſing for another crop.

4. That rain hurts luſerne, when cut, more than it does ſainfoin. It ſhould therefore be houſed as ſoon as it is dry: for this hay cannot be preſſed ſo cloſe together, in cocks, but that the water will penetrate into it, and rot it.

5. If luſerne grows yellow before it is in bloom, it is an almoſt certain ſign that its root is attacked by ſome inſect in the earth. The beſt way in this caſe is, to cut it down, that the graſs may not be loſt, and that the inſects may be deſtroyed before they entirely conſume the root.

6. When the ſeed is to be ſaved, it muſt ſtand till it is quite ripe, and that crop of graſs is loſt.

When the ſeed is quite ripe, the tops of the plants, where the pods grow, ſhould be cut off with a ſharp ſickle, (ſhaking them as little as poſſible,) and laid in a cloth held ready to receive them, on which they are dried in the ſhade, and then beat out and cleaned. The reſt of the graſs is afterwards cut down; rather to clear the field, than for any uſe it can be of; being now too coarſe and hard.

CHAP. IX. SECT. II.

Experiments on luſerne cultivated according to the new huſbandry, by M. DE CHATEAU-VIEUX.

IT is truely with regret, ſays M. de Chateau-vieux, that I am forced to treat a ſubject of this importance, in ſo ſummary a way as the limits of this letter * require. However, I hope that even this general account of my experiments may be a guide to thoſe who would cultivate this plant. Many perſons who live at a conſiderable diſtance from this place †, have already followed my example, and are extremely well ſatisfied with their ſucceſs.

Though I agree with M. Duhamel and the other partiſans of the new huſbandry, that luſerne and ſainfoin thrive beſt when cultivated in beds; yet my practice differs, in many reſpects, from theirs. This difference conſiſts in,

1. *The principle which I apply particularly to the culture of luſerne.*

LUCERNE naturally grows with one large perpendicular root, which penetrates very deep into the earth, and has few, if any, lateral roots. From ſimilar experiments on other taprooted plants, I was induced to think, that this too, by tranſplanting it, and at the ſame time cutting off part of its tap-root, might be made to ſhoot out ſeveral horizontal roots, which, reaching into the looſe mould of the alleys, and extending themſelves there, would collect a greater quantity of nouriſhment for the plant, and conſequently enable it to produce more abundant crops.

The event has proved, that when we reaſon on ſound principles, we ſeldom err. My tranſplanted luſerne puſhed out numbers of large

* His letter to M. Duhamel. † Geneva.

large lateral roots, and theſe branched out again into others, which may be multiplied without end by frequent culture of the alleys: for the horſe-hoe has the ſame effect on theſe horizontal roots, that cutting has upon the tap-root.

2. *The method of tranſplanting the luſerne.*

I Made ſeveral beds, ſome about three feet wide, (including the alleys,) into which I tranſplanted a ſingle row of luſerne; others about three feet nine inches, into which I tranſplanted two rows; and others about four feet three inches wide, in which I put three rows. The deſign of this variation was, to ſee by which of theſe three methods the ſame extent of ground will produce the greateſt quantity of luſerne. I believe it will require five or ſix years to determine exactly which of them will be beſt; becauſe, as the plants increaſe every year in bulk, their produce alters, and may perhaps not keep in proportion to the firſt years, though probably the difference will not be great. But without waiting ſo long, I can already ſee, that *the crop will be greateſt by planting only one row on each bed.*

The plants in the ſingle rows were ſix inches aſunder, nor ſhould they ever be nearer; and thoſe in the double and triple rows, were eight or nine inches diſtant from each other. I muſt obſerve, that I likewiſe ſowed luſerne with the drill, in beds, in which it has remained without tranſplanting. It is very fine; but not near ſo ſtrong and flouriſhing as that which I tranſplanted. When luſerne is ſown where it is to remain, it neceſſarily requires being thinned, and that operation takes up more time than tranſplanting it would do.

Rules to be obſerved in tranſplanting luſerne into beds.

1. THE middle of the beds muſt be raiſed and arched as high as poſſible; and as the luſerne is to remain ſeveral years on the ſame ground, no pains ſhould be ſpared to prepare the earth as well as can be.

2. Luſerne ſhould be ſown in the ſpring, and in a rich mould, that the plants may be ſtrong enough to tranſplant in September.

3. Plants two or three years old, may be tranſplanted equally well.

4. They ſhould be tranſplanted in September, that they may have time to take freſh root before the winter comes on.

5. If they cannot conveniently be tranſplanted in September, it may be done in October, provided it does not freeze.

6. The mould into which they are tranſplanted, ſhould be moiſt; and if the weather be ſomewhat rainy, it is ſo much the better. In this caſe, I have never found it neceſſary to water the plants.

7. If luſerne is tranſplanted in November or December, there is danger of the froſts forcing many of the plants out of the ground.

8. If too warm and dry a ſeaſon prevents tranſplanting in September or October, it is beſt to ſtay till the winter is paſt. The plants will then be ſure of taking root, and very few of them will fail.

9. If they can be tranſplanted in autumn, they will yield pretty good crops the next year: but if they are not tranſplanted till ſpring, the next year's crops will be but indifferent.

10. The plants muſt be taken up out of the nurſery, with great care and patience, that their roots may not be damaged.

11. The roots ſhould be left about ſix or ſeven inches long, and the green tops ſhould be cut off within about two inches of the crown of the root.

12. The plants will take root the ſooner, if they are put in water as ſoon as they are taken up, and kept in it till they are planted.

13. They are planted in holes made with a planting ſtick, in the ſame manner as cabbages or lettices are planted in a garden.

14. The beſt way of planting luſerne is, to cut a ſtrait channel, two or three inches deep, and ſet the plants in the bottom of it, covering them up to the neck.

15. Great care ſhould be taken not to ſuffer any weeds to grow among the luſerne, at leaſt for the two or three firſt years. To this end, the rows ſhould be weeded by hand, as well as the edge of the alleys near the plants, where the horſe-hoe cannot go.

16. The alleys may be ſtirred, either with the ſingle cultivator, or the cultivator with two mould boards; which, at the ſame time that it deſtroys the weeds, keeps the mould looſe.

17. The firſt ſtirring may be given with the ſingle cultivator, with which a furrow may be cut on each ſide of the main furrow in the middle of the alleys, by which means the earth will be turned over on both ſides of it.

18. The ſecond ſtirring may be given with the cultivator with two mould.

mould boards, by drawing it along the middle of the alleys. This will turn the earth towards the rows. By theſe alternate ſtirrings, the alleys will be conſtantly kept in a looſe ſtate.

19. This culture is ſo eaſily performed, and in ſo ſhort a time, that it may be repeated frequently. In this I differ from M. Duhamel, who orders it but ſeldom. My opinion is, that the alleys ſhould be ſtirred once a month, during the whole time that the luſerne is in a growing ſtate.

20. If the alleys keep free from weeds, leſs ſtirring them may do: but the mould ſhould never be ſuffered to grow too hard.

21. As ſoon as ſome of the plants begin to bloſſom, the luſerne ſhould be cut. It will then make excellent fodder, ſuperior to every other kind.

22. The luſerne hay ſhould be dried as quick as poſſible, and frequently turned. The leſs it is expoſed to the heat of the ſun, the better fodder it makes.

23. Luſerne muſt not be houſed till it is dry: but at the ſame time care muſt be taken that it be not too dry: for then, many of the leaves will fall off, as they dry ſooner than the ſtalks.

24. Cattle muſt not have too much given them at a time, till they are accuſtomed to it.

25. No cattle ſhould ever be ſuffered to feed on the beds of luſerne. If the earth is very dry, towards the latter end of the autumn, ſheep will do it the leaſt hurt. If the plants are then tall enough to be mowed, the beſt way is to cut them, and give them green to the cattle.

Theſe rules contain all that is eſſentially neceſſary for making and keeping in good order this kind of artificial paſture. I can ſafely ſay, that whoever tries them, will be abundantly rewarded for his trouble and expence. Sainfoin may be cultivated in the ſame manner.

Account of the produce of Luſerne planted in beds, and cultivated according to the principles of the new huſbandry: with ſome important reflections on the advantages which may be obtained from it.

NO judgment ſhould be formed of what luſerne may produce, by the crops of the firſt or ſecond year: it is then too young to be able to yield much. If we were to calculate even by its third year's produce, we ſhould ſtill conſider, that as the plants increaſe every year in bulk and vigour, (and where they will ſtop I am not yet able to determine,) the produce will be proportioned to that increaſe, and conſequently the crop of each ſucceeding year will be greater than that of the laſt.

The crops I am going to ſpeak of, are thoſe of the ſecond and third year: but my calculations will be made on that of the third year. It is proper to remember that the years 1753 and 1754, were uncommonly dry, inſomuch that ſometimes, not a drop of rain, nor ſcarce any dew, fell between the cutting of one crop and that of another. The ſeaſons were ſo unfavourable to the production of graſs, that hay roſe to an exceſſive price.

I ſhall firſt ſay what was the ſtate of the plants in their third year, and afterwards how much hay they yielded.

State of the plants in their third year.

AS the part of the plant which I now conſider, is that which is buried in the earth, I uncovered numbers of them, that I might be able to judge of their general ſtate. I was greatly ſtruck with the effect which tranſplanting had had upon them. Inſtead of one perpendicular root, which they uſually have, all theſe plants had three, four, five, and ſometimes more, almoſt equally big roots. They were, in general, three quarters of an inch in diameter, and proceeded from the original root, which was now at leaſt an inch in diameter, and in many of the plants an inch and a half. After the moſt careful ſearch which I could poſſibly make, I could not find one plant of luſerne ſown in the common way, tho' it had ſtood twelve, twenty or more years, whoſe tap-root had grown to the bigneſs of an inch diameter: few of them were above half, or at moſt three quarters of an inch thick. This difference is very great.

I likewiſe found that the roots of the tranſplanted luſerne had produced another kind of roots, of which I ſaw none about the roots of the old luſerne. Theſe were a great number of fibrous roots, ſome of which were already one-twelfth of an inch in diameter, and looked as if they would alſo become principal roots.

The ſtalks ſeem to riſe out of the earth; and from the firſt time of cutting them, a kind of head forms juſt above ground, which extends itſelf every year. The firſt year this head was two or three inches wide: the ſecond year, it was generally about ſix inches over; and this third year, almoſt half the plants have a crown ten or twelve inches in diameter: and as many of them have grown ſo as to touch one another, their crowns are become of an oval form, having extended themſelves on the ſides where they met with no reſiſtance.

CROPS.

CROPS.

I Have an arpent of luſerne in beds, divided into two parts. This is the third crop of luſerne off one of them. The beds are forty toiſes in length. In 1753, I cut this luſerne ſix times, *viz.* in May, June, July, Auguſt, September, and the beginning of November. This laſt cutting was not near ſo plentiful as the others, and I dried it within doors.

Theſe ſix cuttings off one bed, on which there was but one row of luſerne, yielded 140 pounds of well dried hay.

In 1754, the luſerne was late before it began to ſhoot, and the earth was drier than the year before. I had but five crops: the firſt was cut the 27th of May; the ſecond, the 1ſt of July; the third, the 27th of July; the fourth, the 26th of Auguſt; and the fifth, the 23d of October. Theſe five cuttings yielded in all 225 pounds of well dried hay off each bed.

A field 40 toiſes long, which was the length of my beds, and 34 toiſes wide, contains an arpent. This arpent divided into 68 beds, each three feet wide, producing after the rate of 225 pounds of hay off each bed, would yield in all 15300 pounds*; which is infinitely more than is ever obtained in the common way.

The beds with three rows yielded much leſs. The third year, their crops amounted to no more than 169 pounds each bed, which is a fourth leſs than the others: and as theſe beds are wider, inſtead of having 68, as in the former diſpoſition of the arpent, there will be only 47, each four feet three inches wide, the total produce of which will be but 7943 pounds: conſequently this arpent will yield little more than half as much as an arpent laid out in beds three feet wide, planted with only ſingle rows.

REMARKS.

THE plants of luſerne had the fate of all kinds of plantations: that is to ſay, ſome of them were more vigorous than others. The greateſt number of theſe plants produced each of them a pound of dry hay, and ſome of them yielded two pounds. I look upon theſe laſt as ſuch extraordinary productions, that I do not expect many of

* Upwards of ſeven and a half Engliſh loads of hay, at 18 hundred weight to the load.

them

them to yield the like quantity again. I think one may be very well ſatisfied, if the plants, one with another, yield a pound of hay a-piece every year. This is nearly the reſult of my experiment on beds which had but one row; and the produce of theſe would have been ſtill greater, if many of my plants had not failed: in the room of which I ſet young ones, which could not acquire ſufficient ſtrength to yield full crops.

In theſe experiments, I have employed no dung: neither have I for any of my corn fields. I have reſerved it for improving my paſtures and meadows; and intend next to apply it to my luſerne, which, I doubt not, will be much the finer for it. The only thing now remaining is, to know by experience which will be the beſt way of uſing it. I have ſome thoughts on that head, which may render it much more profitable.

Luſerne deſerves to be cultivated with care: not only on account of the great quantity of fodder which it yields, but likewiſe becauſe the quality of its hay is ſuperior to any other. The new huſbandry will render it ſtill more perfect. Plants cultivated this way, enjoy the benefit of a free circulation of the air, and that circulation keeps them ſweet and ſound, and free from all muſtineſs towards their roots: for, being open to the rays of the ſun, that great ſource of kindly vegetation, they attain great perfection in all their parts, both as to their ſubſtance, and their flavour. Cattle eat this food greedily, and are better nouriſhed with it, than with any other: but as every exceſs is bad, too great a quantity ſhould not be given them at once, eſpecially at firſt, leſt it ſhould ſwell them. The beſt way is, to bring them to it by degrees.

I have experienced theſe qualities in this hay, by comparing it with every other ſort. The excellence of this, juſtifies the principles on which the new huſbandry is founded. I have offered to my horſes bundles of every kind of hay, and at the ſame time a bundle of this hay of luſerne. They have not heſitated a moment to prefer the latter. Nothing but its ſuperior qualities could determine them in this choice, which has never varied, and has always been in favour of the luſerne cultivated in this manner.

It would be laviſhing this excellent fodder, to feed horſes entirely with it. It need only be given them by turns with common hay; which will be a great ſaving: for this luſerne will ſupply the place of oats. I am certain that *my horſes fed partly with this hay, and without oats, will be in better plight, ſtronger, and more vigorous, than*

than those which are fed with meadow hay and corn in the usual way. It is now some time since I have fed my coach horses with it, and have retrenched their oats. Instead of this last food, and at the hours they used to have it, I give them luserne chopt, as the Spaniards do straw to their horses. Mine are as fond of it, and shew the same impatience to find it in their manger, as if it was oats; and since their being put under this diet, they are in better condition than before, and so mettlesome that the coachman has enough to do to keep them in.

When I said that retrenching the oats would be a considerable saving, I did not so much mean the saving of the expence of that corn, as the better improving of many vast tracts of land which are sown with oats, and might, with proper management, produce much more useful, and more profitable sorts of grain, notwithstanding the too general prejudice, that some lands are not capable of bearing any better. For my part, I am thoroughly satisfied, that whatever ground can bear a crop of oats, can likewise, under the new husbandry, bear any other grain.

Continuation of M. de Chateau-vieux's *account of his experiments on Luserne, in the years* 1755 *and* 1756.

THE great drought of the year 1755, was accompanied with great heat; and the year 1756 was very rainy, and moderately warm, there being but few very hot days in it.

The luserne was exposed to a most severe winter in 1755, when the frost was excessive hard, and lasted very long. M. de Reaumur's thermometer was some days, at different times, 8, 9, 10, 12, and 13 degrees below the freezing point; and on the 3d of February, a thermometer in the open air, stood at 16 degrees * below freezing. These severe frosts made me uneasy for my luserne, which however bore them, without receiving any damage.

The rains in 1756 did no hurt to the plants, but they prevented my

* The greatest cold in the winter of the year 1739-40, sunk Farenheit's thermometer to about 12 degrees, equal to 11 degrees below the freezing point of M. de Reaumur's thermometer. The 16th degree below the freezing point of M. de Reaumur's thermometer, answers to nearly the 3d degree of Farenheit's: consequently the cold was, by Farenheit's thermometer, 9 degrees greater in Switzerland in 1755, than it was here in the severest frost of the very hard winter in 1739-40: and therefore, as M. de Chateau-vieux's luserne was not hurt by that intense cold, there can be no fear of this plant's being killed by any inclemency of the weather in this country.

cutting them at proper times. I had but four crops of lucerne this year, being obliged to wait for an appearance of fine weather to dry it in, before I could venture to cut it down. These rains likewise hindered my giving the proper hoeings to the alleys, which were full of weeds during the summer and autumn. I chose rather to leave them in that condition, than attempt to hoe them while the ground was over wet: not doubting but the spring hoeings would easily destroy them.

In 1755, I cut my lucerne five times: the first was, the 3d of May, before any flowers appeared: the second, the 12th of June: the third, the 15th of July: the fourth, the 21st of August; and the fifth, the 7th of October. I was obliged to finish the drying of this last cutting, in barns and under cover.

In 1756, which was the fifth year of these plants, I cut them but four times: the first, the 3d of June; the second, the 1st of July; the third, the 4th of August; and the fourth, the 27th of September.

A bed 40 toises long, with only one row of lucerne,

Yielded	In 1754	225	pounds of dry hay.
	1755	197	
	1756	281	

In three years, 703 pounds.

A bed of the same length, with three rows of lucerne,

Yielded	In 1754	169	pounds of dry hay.
	1755	180	
	1756	226	

In three years, 575 pounds.

OBSERVATIONS.

We see, by the above account of three years, that a piece of ground laid out in narrow beds, planted with only one row of lucerne, yielded a greater produce than the same extent made into wider beds, and planted with three rows.

I shall not, however, pretend to determine from this one experiment,

ment, that it is beſt to lay down large fields in this manner. I think it will be right to try firſt, whether the ſucceſs will be the ſame on different ſoils, and likewiſe on lands whoſe expoſition may be more or leſs advantageous. If, after repeated trials, the beds which have but one row of plants, yield the greateſt quantity of hay, that method is certainly to be preferred. To clear up this point, ſtill more to my ſatisfaction, I continue to plant luſerne in beds, ſome with one, and others with three rows.

The difference between the crop of 1756, and thoſe of the two preceding years, would induce one to think that rainy ſeaſons are beſt for the production of hay: but ſtill, the greater quantity which the year 1756 produced, muſt not be imputed to the rain only: we ſhould likewiſe conſider, that the plants had throve greatly ſince 1754; that their ſtems were grown much larger, and their roots much ſtronger and more numerous, and that they were conſequently able to yield much greater crops than before. They have abundantly anſwered my expectation, both as to quantity and quality.

With reſpect to the quantity, it is much greater than that of any common fodder: I mean, of any that the ſame extent of ground would have produced, if cultivated in the common way; though it would then have been covered with an immenſe quantity of plants. This is a fact, which numbers of experiments prove, and which we ſhall ceaſe to wonder at when we conſider the great effects of the frequent ſtirring of the alleys. To this it is that I owe the repetition of my crops, and their being all of nearly equal goodneſs. I do not exaggerate, when I ſay, that every ſummer month, which is the time I generally allow between each cutting, will produce ſhoots two feet long, and ſometimes more: and ſuppoſing that I cut them but five times a year, each plant will have produced after the rate of nine or ten feet length of ſhoots, and that in the ſame time that moſt meadows will not produce graſs above two feet long.

As to the quality of this hay, I continue to prefer it to all other fodder. My experience has confirmed what I ſaid of it in 1754; and I ſhall only add, that I have ſince found that it is as good at the end of four years, as when it is firſt cut. If there was any difference, horſes would ſoon be ſenſible of it: but they eat of either without diſtinction.

I feed my horſes with it, chiefly in the ſummer, at which time they do moſt work, and am more and more ſenſible of the advantages of it. Five or ſix pounds of luſerne a day, are ſufficient for a middle siz'd horse: but the quantity may be increased or diminished, according as the horse is nourished by it; for in that there is great difference.

We shall conclude this article with some experiments on the culture of this plant, communicated to Mess. de Chateau-vieux and Duhamel, by different persons, and with an experiment made by M. Duhamel himself.

In April 1753, M. Diancourt sowed luserne in rows, of which many plants produced an ounce of hay apiece in September following. In June 1754, the same plants yielded 12 ounces and a half each. He reckoned that, one with another, each plant had afforded him a pound of hay, which is a very great crop. On an arpent sown in double rows, he had 26400 plants*; and on another sown in single rows, 15400†: but whether the plants in the single rows were so much larger and more vigorous, as to compensate for the greater number in the double rows, was what he could not determine at the time of his communicating this.

M. de Pontbriant of Rennes in Britany, rightly judging that one of the most essential services he could do his country, would be the improving of the pasture of that province, which is famous for the production of cattle; planted luserne, to shew the people how small a space of ground, and that too cultivated by the very cattle which are fed upon it, will produce a greater quantity of much better fodder, than all the grass which their vast commons and extensive pastures yield them.

In September 1755, he transplanted luserne from a field which was to be fallowed. The roots of the plants were three or four feet long. He planted them in furrows six feet distant, and the plants eight or ten inches asunder, in a field which he thought free from weeds. In this he was mistaken: for, though the luserne made very good shoots, yet, by neglecting to hoe the alleys, weeds came up, and over-run the ground.

He mowed the whole, then horse-hoed it, and planted a new row of luserne between each of the former rows; and expects that next year will yield him several good crops; which M. Duhamel thinks he may depend on, if he can but get the better of the weeds.

* A pound of dry hay from each of these plants, would amount to upwards of 13 loads of hay.

† At the same rate, these would produce about 7 loads and a half, at 18 hundred weight to the load.

A gentleman at Montelimart in Dauphiny, writes as follows to M. de Chateau-vieux.

" In the autumn, I tranfplanted from a fpot of luferne three years " old, as many plants as were requifite for a fpace of 48 fquare " toifes made into beds. The middle of the beds was raifed very " high, and I planted only a fingle row in each. The firft cutting " yielded me one trufs of hay; the fecond, four; the third, fix. " The fhoots of the laft cutting were pretty tall, and feemed to be " wanting only in number: that, without doubt, will come by and " bye, when the roots fhall have multiplied and grown ftronger. I " hope that the heat of this climate will not ftop their growth: for " I take care to ftir the alleys as often as the luferne is cut.

" A little later in the feafon, I planted 220 toifes more with " luferne, which I watered, becaufe the weather was cold and dry. " The plants fucceeded very well, excepting a few which died. " The firft cutting was very weak; the fecond, middling; and the " third is now growing, it being but 17 days fince the laft was cut. " Several of the fhoots are already 18 inches long. I have not yet " dunged any of thefe beds: but I intend to dung them all next " winter, in order to quicken the growth of the plants, and give " them greater ftrength."

The fame gentleman writes again to M. de Chateau-vieux, the 12th of September, 1755, to the following effect.

" I have already cut my luferne in the new way, five times, and " hope to have a fixth cutting towards the end of this month. As " the drought does not cripple my plants, but only retards their " growth for about a week, I cut them at the end of 25 days, when " they were in full bloom: whereas, in this feafon, they require at " leaft a month. The ftalks are full as ftrong, and the leaves as " large, as thofe of luferne which is well dunged, and plentifully " watered every fortnight. The only inconvenience I find, and that " not a great one, is, that this luferne is difficult to mow*, becaufe " the ftalks do not ftand to the fcythe, and many of them trail upon " the ground. This year, I have ufed a fickle; but it does not dif- " patch the work fo quickly as a fcythe. Perhaps ftirring of the

* This inconvenience, fays M. de Chateau-vieux, is but a fmall hindrance. I mow my luferne, and it ftands the fcythe very well, efpecially the fecond year. A few ftalks which may efcape the fcythe, are of little confequence; and expert workmen will leave but few, even of them. I have a plantation of luferne which is always cut with a fickle, though it would very well bear the fcythe. This I do, that, by lofing none, I may be able to judge the more exactly of its produce.

alleys

" alleys with the cultivator and plough, (neither of which I have " uſed this year,) to clear the ground of weeds and looſen the " mould, may help to ſtrengthen the ſtalks: and as they grow " thicker every year, they will be better able to bear the ſcythe. I " have prepared a great deal more ground, to enlarge my plantations " of luſerne. The drought ſtops me for the preſent; but as ſoon as " the rains ſhall have moiſtened the earth, I intend immediately to " plant a ſurface of ſeven or eight hundred toiſes."

The following letter to M. de Chateau-vieux, is dated from Chateau-Gaillard in the Upper Bugey, near Lyons, June 6, 1755.

" Luſerne which I ſowed laſt March, obſerving your directions in " the culture of it, is now two feet high; which plainly ſhews me, " that I ſhall be able to cut it ſix times next year. Some of my " neighbours have ſown luſerne, mixed with oats, in a better ſoil " than mine, but without horſe-hoeing it, or ſtirring the ground " between the plants. It is now but two inches high, and is in " danger of being deſtroyed by the drought, which mine is not."

A letter from the ſame, dated July the 5th, 1755, ſays,

" On the 20th of June, I cut my luſerne which was ſown in " March. It was three feet high when I cut it, and has already made " freſh ſhoots thirteen or fourteen inches long. I have let ſome of " it ſtand, which will produce good ſeed. This will afford me an " opportunity of convincing the moſt incredulous, of the ſuperior " excellence of the new huſbandry.

This luſerne, after having been cut a ſecond time, was two feet high on the 17th of Auguſt; whilſt that ſown in the old way, and mixed with oats, had not been cut at all, and was but four inches high.

M. Duhamel himſelf, in the autumn of 1755, took up the roots of an old field of luſerne, which were about the thickneſs of a man's thumb, and ſix or ſeven inches long, and replanted them in trenches. All his huſbandmen told him that they were worn out, and too old to ſhoot again: but yet not one of them failed. They yielded three cuttings the firſt year, tho' the ſoil was by no means proper for them. As there ſtill remained ſome rows which could not be tranſplanted in the autumn, he removed them the next ſpring. Many of theſe plants periſhed; and the ſhoots of thoſe which took, were much ſhorter than thoſe of what had been tranſplanted in the autumn. To repleniſh the empty ſpaces, he laid down ſome ſlips of the neighbouring plants, by which means he hoped thoſe chaſms would be filled up the next year.

This is a very ſimple and eaſy way to renew old paſtures of luſerne, and to have conſtant crops of this excellent fodder. Great care is requiſite, both in taking up the roots, and in planting them again.

CHAP. X.
Of CLOVER.

M. Duhamel ſays but little of this plant, whoſe great uſe will, we hope, apologize for our borrowing from other authors, and particularly Mr. Miller, ſuch directions as may be ſufficient to guide our huſbandmen in the culture of it.

There are many ſorts of clover: but the two principal ones are, the red and the white.

Clay lands, in particular, have been ſo much improved by ſowing them with red clover, that they have produced ſix times the quantity of fodder that they uſed to do before the culture of this plant was ſo common in England as it now is.

The red clover is a biennial plant, whoſe roots decay after they have produced ſeeds: but if the plants are eat down, or mowed when they begin to flower, they will ſprout out anew, and by that means continue longer than they otherwiſe would. The uſual allowance of ſeed for an acre of ground, in the common huſbandry, is ten pounds. In the choice of the ſeed, that which is of a bright yellow colour, inclining to brown, ſhould be preferred; and the pale coloured thin ſeed ſhould be rejected.

The general cuſtom in this country is, to ſow the clover ſeed with barley, in the ſpring: and when the barley is taken off the ground, the clover ſpreads and covers it, and remains two years: after which the land is plowed again for corn, and is thought to be greatly enriched by the clover. The clover ſeed ſhould not be ſown, till after the barley has been harrowed in; for otherwiſe it would be buried too deep: and after it is ſown, the ground ſhould be rolled, to preſs the ſeeds into it: but this ſhould be done in dry weather, becauſe moiſture will often make the ſeeds burſt, and when the ground is wet, they will ſtick to the roller, and the ſurface of the ſoil will be ſo hardened by the rolling, that numbers of plants will fail, for want of being able to pierce it. This is the general method, when clover is ſown with corn: but it would be much better always to ſow it alone; for then the plants come on much faſter, and are not choak-

ed,

ed for one whole ſeaſon, as they frequently are in the other way, when the crop of corn is great.

Mr. Miller, after many years trial, adviſes therefore to ſow the ſeeds of clover in Auguſt, when there is a proſpect of rain ſoon after: becauſe the ground being then warm, the firſt ſhower of rain will bring up the plants, and they will have time enough to get ſtrength before the winter; and a good rolling in October, when the ground is dry, will preſs it cloſe to the roots, and make the plants ſend out more ſhoots: and this he adviſes repeating again in March. The reaſon of his preferring this ſeaſon for ſowing clover, rather than the ſpring, is, becauſe the ground is cold and wet in ſpring, and if much rain falls after the ſeeds are ſown, they will rot in the ground; and many times when the ſeed is ſown late in the ſpring, if the ſeaſon ſhould prove dry, the ſeeds will not grow.

About the middle of May, this graſs will be fit to cut; when particular care ſhould be taken in making it into hay: for it will require a great deal more labour and time to dry, than common graſs, and will ſhrink into leſs compaſs: but if it be not too rank, it will make excellent food for cattle. The time for cutting it is when it begins to flower; for if it ſtands much longer, the lower part of the ſtems, and the under leaves, will begin to dry, and the quantity of hay will then be leſs, and not ſo well flavour'd. Care ſhould likewiſe be taken not to ſtack it till it be thoroughly dry, for fear of its heating.

One acre of this plant will feed as many cattle as four or five acres of common graſs: but they muſt not be ſuffered to eat too plentifully of it at firſt, leſt it burſt them. It ſhould be given them by degrees, till they are fully ſeaſoned to it: nor ſhould they ever be turned into this food in wet weather. Some ſow rye graſs amongſt their clover, and let them grow together, in order to prevent the ill conſequences of the cattle feeding wholly on clover: but in this they are to blame, becauſe the rye graſs does great injury to the clover. This plant is reckoned much better fodder for moſt other cattle, than for milch cows; wherefore theſe ſhould ſeldom have any of it: tho' when it is dry, it is not near ſo hurtful to any ſort of cattle, as when green.

When the ſeeds of clover are deſigned to be ſaved, the firſt crop in the ſpring ſhould be let ſtand till the ſeeds are ripe, which is known by the ſtalks and heads changing to a brown colour: and then it ſhould be cut in fair weather, and be well dried before it is

laid

laid up; for otherwise the feeds will not eafily quit their hufks, when it is threfhed. To this is owing a common complaint of farmers, that they oftentimes cannot threfh out their clover-feed without great labour and difficulty. It will generally be found in this cafe; that thefe are fecond crops, which ripen late in autumn, when there is not heat enough to dry the hufks fufficiently to make them part eafily from the feed.

The white clover, generally known amongft farmers by the name of white honeyfuckle, is a lafting plant, whofe branches trail upon the ground, and fend out roots from every joint, fo that it thickens and makes the clofeft fward of any of the artificial graffes. It is an exceeding fweet food for all forts of cattle: for which reafon, when land is defign'd to be laid down for pafture, and to continue fo, a quantity of the feeds of this plant fhould always be fown with the grafs feeds. The ufual allowance of this feed, is eight pounds to an acre: but this fhould never be fown with corn; becaufe the corn will weaken it fo that it will fcarce be worth ftanding. And yet, as Mr. Miller obferves, fuch is the covetoufnefs of moft farmers, that they will not be prevailed on to alter their old cuftom of laying down their grounds with a crop of corn, though they lofe twice the value of their corn, by the poornefs of the grafs, which never will come to a good fward; and one whole feafon is alfo loft: for if this feed is fown in the fpring without corn, there will be a crop of hay to mow by the middle, or latter end of July, and a much better after-feed for cattle the following autumn and winter, than the grafs which is fown with corn will produce the fecond year.

The author of the new fyftem of agriculture agrees with Mr. Miller, that clover fhould be fown in autumn, and always by itfelf, on land brought to the fineft tilth poffible, and clear'd of all fibrous roots and other trafh, by going over it with fine tooth'd harrows: but he differs from him in regard to the quantity of feed, the former ftrongly recommending never to fow lefs than twenty pounds upon an acre.

He obferves that " many will object againft this, as a double " charge, becaufe, fay they, I never knew any man who fowed above " half that quantity.——I anfwer," continues he, " they never " knew any man who reap'd half the profit which he might have " done by it, if they had followed my directions. It is obfervable, " that there are more ignorant men, who profefs hufbandry, than " of any other art; and yet fewer of this profeffion, than any of the "rest, who think they can be taught. A man, not possessed of "this temper, would easily imagine that the thicker this little seed "is sown, the thicker it will spring, and the better keep down all "weeds, and common grass, and, consequently, become of double "advantage.

"Sowing clover in September, instead of the spring, and sowing "it alone, has many conveniencies: it will rise thick, and swarth "the ground, before the hard weather comes in; and thereby not "only gather strength, to defend itself against the winter frosts; but "will be so early in the spring, that you might mow it, the first "time, in the very beginning of May, or, perhaps, sooner.

"When the first hard frosts have bound the earth so fast that "you may bring horses upon it, without damage to the roots of the "clover, this is the very point of time in which you should bestow "about eight or ten load of sea-ouze, sea-sand, sheep's dung, or "that of our stercorary, upon every acre, taking care to spread it as "equally as may be, that, when the frost dissolves, the rains may "drive the strength of the manure into the earth, which, in the "tender infancy of the new turf, will easily admit it, to the nourish-"ment of the roots, and surprising increase of your clover, both as "to quantity and sweetness."

M. Duhamel mentions the following experiment, made by M. de Pontbriant of Rennes in Britany. He sowed 296 square toises, with flax and hemp, mixed with clover seed. As soon as the former were plucked up, the clover appeared, and grew so well that it was cut in November of the same year. It was weeded in February, and mowed again in the beginning of May. As it was too thick, he made alleys in it a foot wide. These alleys furnished him with plants enough to garnish 888 square toises of land. He looks upon the first spot as a nursery, from which he takes whatever plants he wants, and sets them in other ground a foot and a half asunder, which is a sufficient distance for hoeing. His field promises greatly.

CHAP. XI.

Of Meadow, or Pasture Ground.

PASTURE ground is of two sorts: *viz.* low meadow land, which is often overflowed; and up-land, which lies high and dry. We shall begin with this last.

The

The firſt thing requiſite in this paſture, is, to fence it in, and divide it into fields of from four or five to ten acres each; planting timber trees in the hedge rows, to ſcreen the graſs from the ſharp drying winds of March, which are ſo prejudicial to its growth in large open fields, that if April proves likewiſe a cold dry month, the land produces very little hay: whereas in ſhelter'd fields, the graſs will begin to grow early in March, and will cover the ground ſo as to prevent the ſun from parching the roots of the plants, which will be kept growing, and afford an early crop, if the ſpring is dry.

A general caution to be obſerved in fencing of land, eſpecially where the hedge rows are planted with trees, is, not to make the incloſures too ſmall: becauſe when the trees are grown high, they will ſhade the ground too much; and where they are too cloſe, the graſs will be rank and ſour.

The turf ſhould be made good, by ſowing new ſeed, wherever the graſs has been deſtroyed, whether by the badneſs of the ſoil, or for want of proper care, or by weeds, ruſhes, buſhes, mole-hills, *&c.* If the land is cold and clayey, it may be improved by paring off the ſurface, and burning it, as before directed: but if it is a hot ſandy ſoil, chalk, lime, marle, or clay, are proper manures to lay upon it, and that in pretty large quantities, for otherwiſe they will do little good. If the ground is over-run with buſhes, ruſhes, *&c.* they ſhould be grubbed up towards the end of the ſummer, and burnt, and their aſhes ſpread over the ground juſt before the autumnal rains; at which time the ſurface of the land ſhould be levelled, and ſown with graſs-ſeed, which will come up in a ſhort time, and make good graſs the following ſpring. All mole-hills ſhould likewiſe be pared off, and burnt for their aſhes, or be ſpread thin upon the ground, after digging out their middle or core; and the holes ſhould be left open all the winter, to deſtroy the ants.

It is of great ſervice to roll the turf, in February and March, with a heavy wooden roller; always obſerving to do it in moiſt weather, that the roller may the better level the ſurface. This renders the mowing of the graſs much eaſier than when the ground lies uneven, and alſo makes the turf thicker, and the graſs grow the ſweeter. Mr. Miller thinks it likewiſe a great help to deſtroy weeds.

Feeding of up-land paſtures, every other year, is another improvement of them: for where this is not practiſed, the land muſt be manured at leaſt every third year. The time to ſpread the manure,

nure, is the autumn, before the rains have ſoaked the ground, and rendered it too ſoft to cart on. If the manure is laid on at this ſeaſon, and carefully ſpread; and all the clods well broken, the winter rains will waſh the ſalts down to the roots of the graſs, which will receive the advantage of it the following ſpring.

Particular care ſhould be taken to deſtroy all weeds in the paſture, every ſpring and autumn: for otherwiſe, they will ripen their ſeeds, which will ſpread over the ground, and kill the graſs: nor can they afterwards be rooted out, without great difficulty.

The graſs of upland paſtures ſeldom degenerates, if the land is tolerably good: but that of low meadows, which are overflowed in winter, grows harſh and ruſhy in a few years.

" There is no part of huſbandry," ſays Mr. Miller, " of which " the farmers are, in general, more ignorant than that of the pa- " ſture. Moſt of them ſuppoſe, that when an old paſture is plowed " up, it can never be brought to have a good ſward again: ſo their " common method of managing their land after plowing, and get- " ting two or three crops of corn, is to ſow with their crop of " barley, ſome graſs ſeeds (as they call them); that is, either the " red clover, which they intend to ſtand two years after the corn is " taken off the ground, or rye-graſs mixed with trefoil; but as all " theſe are at moſt but biennial plants, whoſe roots decay ſoon after " their ſeeds are perfected, ſo the ground, having no crop upon it, " is again plowed for corn: and this is the conſtant round which " the lands are employed in, by the better ſort of farmers; for I " have never met with one of them, who had the leaſt notion of " laying down their land to graſs for any longer continuance: there- " fore the ſeeds which they uſually ſow, are the beſt adapted for " this purpoſe.

" But whatever may have been the practiſe of theſe people, I " hope to prove, that it is poſſible to lay down land, which has " been in tillage, with graſs, in ſuch manner as that the ſward ſhall " be as good, if not better, than any natural graſs, and of as long " duration. But this is never to be expected in the common me- " thod of ſowing a crop of corn with the graſs-ſeed; for wherever " this has been practiſed, if the corn has ſucceeded well, the graſs " has been very poor and weak; ſo that if the land has not been " very good, the graſs has ſcarcely been worth ſtanding: for the " following year it has produced but little hay; and the year after, " the crop is worth little, either to mow or feed: nor can it be

" expected it ſhould be otherwiſe; for the ground cannot nouriſh " two crops."

In conſequence of this, Mr. Miller proceeds to give the following directions for the management of paſture ground.

When ground is laid down for graſs, no crop of any kind ſhould be ſown with the ſeeds, and the land ſhould be well plowed, and cleaned from weeds. The beſt ſeaſon to ſow the graſs-ſeeds, upon dry land, is about the middle of September, or ſooner, if there is an appearance of rain; becauſe, the ground being then warm, if ſome good ſhowers of rain fall after the ſeed is ſown, the graſs will ſoon make its appearance, and get ſufficient rooting in the ground before winter, not to be in danger of being turned out by the froſt; eſpecially if the ground is well rolled before the froſt comes on. If the graſs comes up well, this rolling ſhould be performed towards the end of October or the beginning of November, and repeated again the beginning of March. The ſward will, in this caſe, be cloſely joined at the bottom, and a good crop of hay may be expected the ſame ſummer. In cold lands, which lie very open and expoſed, it will be right to ſow the ſeeds a month earlier, that the graſs may have time to get good rooting, before the cold ſeaſon comes on to ſtop its growth. If the ground cannot be prepared for ſowing in autumn, it may be ſowed in the middle or latter end of March, according as the ſeaſon is early or late. The danger of ſowing late, is, dry weather; eſpecially if the ſoil is light and dry. It will then be proper to roll the ground well, ſoon after the ſeeds are ſown; to ſettle the ſurface, and prevent its being blown away, together with the ſeeds, as has frequently happened, by the high winds in March.

The beſt ſeed for this purpoſe, is the beſt ſort of upland hay-ſeed, taken from the cleaneſt paſtures, where there are no weeds. Three, or at moſt four buſhels of this ſeed, well ſifted and cleanſed, are ſufficient to ſow an acre of land. The next beſt is, white clover-ſeed, of which eight pounds are ſufficient for an acre. The graſs-ſeed ſhould be ſown firſt, and the white, or, as it is commonly called, Dutch clover-ſeed afterwards: but they ſhould not be ſown mixed together, becauſe the clover-ſeeds, being heavieſt, will fall to the bottom, and the ground will conſequently be unequally ſown.

After the ſeeds are ſown, the ground ſhould be harrowed lightly to bury them; but this ſhould be done with a ſhort tooth'd harrow; for

for otherwiſe the ſeeds will be buried too deep. If the ſurface of the ground is dry, it ſhould be rolled, two or three days after ſowing, with a barley roller, to break the clods, and ſettle the ground; which will prevent the ſeeds from being removed by the wind.

When the ſeeds are come up, the ground ſhould be weeded: otherwiſe the weeds will increaſe, ſo as to keep down the graſs, and ſtarve it: and if they are ſuffered to remain till they have ſhed their ſeeds, they will over-run the land, and entirely deſtroy the graſs. One of the principal parts of huſbandry, is never to ſuffer weeds to grow.

If the ground is rolled two or three times, at proper intervals, after the graſs is up, it will make it form a thicker bottom: for as the white clover puts out roots from every joint of the ſtalks which are near the ground; the roots will mat ſo cloſely together, as to cover the whole ſurface of the ground with a ſward capable of reſiſting any common drought.

Where paſtures are laid down to remain, the white clover is certainly the beſt ſort to ſow, becauſe it is a laſting plant, and does equally well on wet or dry land. The hay ſeeds, though taken from the very beſt paſtures, will be compoſed of various ſorts of graſs, ſome annual, and others biennial; ſo that when they go off, many large patches of ground will remain bare and naked, if there is not a ſufficient quantity of that clover, to cover the land. Every ſummer affords us proofs of this, in all our common paſtures, in which we frequently ſee no other verdure left, but this clover, which grows naturally upon gravel and clay, in moſt parts of England: a plain indication how eaſily this plant may be cultivated to great advantage, in moſt ſorts of land throughout this kingdom.

It is therefore plainly owing to our farmers not diſtinguiſhing graſſes which are annual, from thoſe which are perennial, that land which has been in tillage is not brought to a good turf again, in the common method of huſbandry: for annual and biennial graſſes will ſoon decay, and nothing can be expected to ſucceed them, but what will grow naturally, except, perhaps, on ſome ſpots, where their ſeeds may chance to have ripened and ſown themſelves. This, added to the covetous method of laying down the ground with a crop of corn, has been the true cauſe of the decreaſe of paſture in many parts of England, where it is now much more valuable than arable land.

After the ground has been brought to a good ſward, the way to preſerve ferve it fo, is to roll it conftantly every fpring and autumn, with a heavy roller, and to keep it clear from all forts of weeds. Dreffing of thefe paftures every third year, is alfo neceffary; for otherwife, it cannot be expected that this ground, which has not the benefit of tillage, fhould continue to produce good crops: and another thing proper to be obferved, is to change the feafons of mowing, and not to mow the fame ground every year; but to mow one feafon, and feed the next: for ground that is mowed every year, will foon be exhaufted, if it has not a conftant fupply of manure.

A great advantage of dry upland paftures, is that they may be fed all the winter, which low wet meadows cannot be.

Meadow land will indeed produce a much greater quantity of hay than upland pafture, and will not require manuring fo often: but then the upland hay is infinitely better, and far fweeter food for cattle.

There are two kinds of meadows in England, the one called water-meadows, and the other only meadows.

Mr. Worlidge diftinguifhes three forts of water meadows; *viz.* 1. Such as lie flat on the banks of great rivers, and are fubject to be overflowed by them in times of land floods only. 2. Such as lie near fmaller rivers or ftreams, and are capable of being drowned or watered, by diverting fuch river, or fome part thereof, out of its natural current, over them. 3. Such as lie above the level of the water, and are flowed by raifing the water by art.

On the borders of our great rivers and currents, are the richeft meadows, confifting generally of a very good fat foil, compofed, as it were, of the fediment of the water overflowing them after great and hafty rains. Thefe are capable of but little farther improvement. But when their foil is naturally dry and hungry, and they are not frequently overflowed by land-floods, artificial works may be made ufe of to raife the water over them, to very confiderable advantage.

The art of diverting fmaller rivers and ftreams, over the meadows near them, is univerfally known and practifed, and to great advantage.

Where the water is fituated above the level of the ground intended to be flowed, it may eafily be let in, at proper feafons, by drains, like thofe hereafter directed for draining of land. Care fhould be taken to have good fluices at the heads of the drains, that the water may not come in, but when it is wanted; for otherwife the meadow, inftead of being improved, would be greatly damaged by it.

Where the land lies above the level of any water near it, the over-flowing

flowing of it will be more expenſive; becauſe the water muſt, in that caſe, be raiſed by machines. The moſt common engine uſed for this purpoſe, is the Perſian wheel, of which Mr. Worlidge gives the following deſcription.

" This wheel is made much after the manner of that of an under-
" ſhot mill, *viz.* with a double ring, into which are let two pins,
" on which the floats are faſtened. Theſe floats are made hollow:
" the half that is moſt remote from the wheel, holds the water which
" is taken in at the open place, above the middle of the back of the
" float, and as the wheel goes round, and the float laden with water
" riſes, ſo the water by degrees, tends towards that part of the float
" which is next the wheel, and as the float ſurmounts the ciſtern or
" receiver, the water empties itſelf into it, every float ſucceeding
" th'one the other, emptying itſelf into the receiver: ſo that if one
" float contain a gallon of water, and there be 30 floats on the wheel,
" at one motion round it delivers 30 gallons of water into the ciſtern.
" Such a wheel will be about 15 foot diameter, the floats at 18
" inches diſtance, and will deliver the water at 11 or 12 foot above
" the level of your ſtream, and will go four times round in one
" minute, and carry up about 120 hogſheads of water in an hour,
" with 12 or 18 inches penning or ſtopping of but an ordinary cur-
" rent of water, which will water very well 30 or 40 acres of land:
" for if your land be cold and clayey, too much water does it hurt;
" and if it be light, warm, or ſandy, a little water does it much good.
" It is alſo to be obſerved that this motion is conſtant, and will laſt
" many years without repair, ſo that it ſtand not ſtill, the one ſide
" drying and waxing lighter than the other: alſo obſerve, that the
" ſlower it moves, the better it delivers the water.

" The view of this wheel we have in Pl. I. Fig. 2. *aaaa* ſignify
" the wheel; *b*, the ciſtern that receives the water; *cc*, the troughs
" ſtanding on treſſels, that conveys the water from the ciſtern to the
" place you deſire; *d*, the hatch, or pen-ſtock that bays up the water
" to a reaſonable height, under which the water drives the wheel;
" *e*, one of the floats preſented to your eye, apart from the wheel;
" *f*, the open place that is to receive the water; *g*, the open place
" out of which the water iſſues; *hh*, the two pins or ledges riveted
" on to the foreſide of the float, and wherewith you are to fix the
" float to the two rings of the wheel. Theſe, or ſuch like wheels,
" are much uſed in Spain, Italy, and France, and are eſteemed the
" moſt eaſy and advantageous way of raiſing water in great quantity,

" to

" to any height within the diameter of the wheel, where there is any " current of water, to continue it in motion, which a ſmall ſtream " will do.

" How many acres of land lie on the declining ſides of hills, by " the ſides of rivers, in many places where the water cannot be " brought unto it by any ordinary way? yet by this wheel placed in " the river, may the land be continually watered ſo far as is under " the level of the water when raiſed."

Mr. Worlidge proceeds to obſerve, that there are many large and flat pieces of land, bordering upon rivers, in which the Perſian wheel cannot be placed without treſpaſſing upon the oppoſite neighbour, *&c.* but where wind-mills may be erected on the higheſt part of the land you intend to overflow. Though this place may be at ſome diſtance from the river, the water may be eaſily conducted thereto by an open or ſubterraneous paſſage from the river.

Such mills are experienced to be of great ſervice in draining of fens and marſhes, and may likewiſe be uſed to great advantage in raiſing ſalt water to overflow meadows lying near it: but above the level of high water. Theſe ſalt-marſhes, as they are called, have been found an excellent remedy for many diſeaſes of horſes and other cattle.

When the water is brought to the deſired height, the main channel ſhould be cut, giving it a convenient deſcent ſo as juſt to keep the water in motion. The mouth of the channel ſhould be of breadth, rather than depth, ſufficient to receive the whole ſtream; and as the water is carried off in leſſer channels, the main channel ſhould be made narrower by degrees, ſo that the water may preſs into the leſſer channels which iſſue all along from the main one. The leſſer channels ſhould be as ſhallow, and as many in number as can be: for though cutting ſo much turf may ſeem to waſte a great deal of land, yet it proves not ſo in the end; for the quicker the water runs over the graſs, the greater the improvement is. Care ſhould be taken to cut the drains in ſuch manner, that no water may remain to ſtagnate upon the land.

The farmer muſt be cautious not to bring any water of mineral ſprings upon his paſture; ſuch being either deſtructive of graſs, or producing a very harſh coarſe kind of it.

Cold, clayey, ſtrong lands, which lie flat, are not improved by watering; for the water cannot penetrate ſuch. Light, warm, dry, ſandy ſoils, are thoſe which are moſt benefited by watering.

A very wrong cuſtom prevails amongſt our farmers in general, with respect to these low grounds; which is, that of flowing them all the winter. The roots of all the sweetest kinds of grass are thereby destroyed, and only such left as are natives of marshes, which are coarse and sour, and which no cattle will eat.

The method which Mr. Miller proposes for the management of these meadows, is, never to flow them till the middle or latter end of March, excepting once or twice in winter, when there may happen floods, which may bring down a great deal of soil from the upper lands, at which time it will be of great service to let water upon the meadows, that the soil may settle there: but the sooner the wet is drained off after this is lodged, the greater advantage the meadows will receive by it. By letting on the water frequently, from the end of March to the middle of May, the growth of the grass will be greatly assisted, and there will be no danger then of destroying its roots. It will also be of great service to these meadows to flow them again, if the season should prove dry, after the hay is carried off the ground: but when this is done, no cattle should be turned into the meadows, till the surface is become firm enough to support their weight without poaching the land; for otherwise the grass will suffer more by the treading of the cattle, than it will receive benefit by the flowing.

Weeding of these meadows twice a year, *viz.* in April and October, by cutting up the roots of docks and all other weeds, will be another great improvement of them: and so will, rolling them with a heavy roller, in spring and autumn. This last operation will level the surface of the ground, whereby it may be mown much closer, and will also sweeten the grass.

The same care should be taken to weed and roll meadows which cannot be flowed, and likewise not to suffer heavy cattle to graze upon them in winter when they are wet. They should therefore be fed down as close as possible in the autumn, before the heavy rains come on: and those pastures which are drier, may be kept to supply the want of these in winter. If there should not be cattle enough to eat down the grass in time, it will be much better to cut off what is left, than to suffer it to rot upon the ground; for that will hinder the grass from shooting early in the spring. The closer it is eaten down in the autumn, the better it will come up the following spring.

Those who are best skilled in this part of husbandry, dress their meadows every other, or at least every third year, without which no good

good crop of hay can be expected: but the generality of farmers, following the old method, are so much distressed for dressing to supply their corn land, that they have not any to spare for their meadows. A most ill-judged management, which, we hope, what has been said in the foregoing part of this work, particularly by M. de Chateau-vieux, will shew them the absurdity of. What dung they do use, is generally laid on in the beginning of winter, and spread as soon after as can conveniently be done: in which situation it remains all the winter. When the frosts are over, the dung is raked anew, and the clods in it are broken. The gross and useless parts, which would only obstruct the growth of the grass, are then carried off*; and if the dung is not sufficiently rotted, they amount, sometimes, to almost as many load as were first laid on.

The advantage which plants receive from dung spread upon the surface of the ground, arises from the rich particles of the dung being as it were filtrated through that surface, and carried down into the earth, by rain or the melting of the snow: but many of those particles are undoubtedly lost, and never reach the roots of the plants.

M. de Chateau-vieux, sensible of this inconvenience, particularly with respect to grass lands; rightly concluded, that the dung would have a much greater effect, if only just the surface of the meadow could be cut, and some of the internal parts of the earth laid open, so that the enriching particles of the dung may more immediately reach the roots of the grass.

He has succeeded admirably in this important improvement, by means of his three-coulter'd plough. In November, or December, the whole surface must be cut with that plough into slips of three inches breadth, which is the distance between each of the coulters. This will have two effects: first, the coulters will tear up great part of the moss with which all old pastures are infected, and gradually destroy it. Secondly, the coulters piercing into the earth five or six inches deep, cut the extremities of many of the roots of the grass, and those cut or broken roots afterwards produce new ones, which give fresh strength and vigor to the plants, and, as it were, renew and make them young again.

* This operation is indispensably necessary, when dung is used which is not thoroughly rotten: because the straw of such dung, mixing with the grass, gives cattle, and particularly horses, a great dislike to it. For this reason, careful farmers always let the dung be well rotted, and reduced to a perfect mould before they lay it on their meadows, or, for want of such dung, they use ashes, pigeons dung, soot, lime, chalk, marle, &c.

This division of the surface of the ground, will be very beneficial to the meadows. If the following year proves wet, it will greatly favour the production of new roots.

To render this improvement still more perfect, as soon as the whole surface of the meadow is cut, dung must be carried on it, and spread as soon after as possible. The smaller the dung is broken, the more useful it will be: because the small particles will be carried by the rain into the traces which the plough has cut, and give surprising strength to the plants.

This method of repairing and improving poor or worn out meadows and pasture grounds, does not require any great quantity of dung: one load of it will go as far, in this practice, as three would in the common way; and be much more beneficial to the grass. M. de Chateau-vieux has tried it for some years, with all the success he could desire. His grass, thus improved, has always been very thick and long, and has yielded him plentiful crops of hay, when fodder has been extremely scarce every where else. In his opinion, one arpent thus cultivated, will produce as much grass as ten in the common way.

Another use which he makes of the three coulter'd plough is, to break up grass lands intended to be converted into arable. The coulters enter five or six inches deep into the ground, and cut the turf into parallel slips of about three inches breadth. Two horses will draw this plough with ease, even though it should have five coulters instead of three, as it may, for the sake of greater expedition.

When the whole surface is thus cut in slips, all in the same direction, M. de Chateau-vieux plows the field cross-ways with a common plough, taking only about the breadth of six inches at each turn of the plough; by which means those slips of grass are broken into pieces, the largest of which are not above six inches long and three inches wide.

These plowings should be performed before winter and in the spring. The lumps of turf, exposed on all sides to the penetrating frosts of winter, are either quite moulder'd down, or rendered so friable thereby, that the field may be plowed afterwards with as much ease as if it had been tilled for several years.

M. de Chateau-vieux's description of this plough, is as follows.

The three coulter'd plough, *Plate* I. *Fig*. 3. consists of a beam *A, B,* two handles *C, D,* supported by the piece *E.* The two pieces

pieces of wood *F, F*, are faſtened firmly to the beam by two ſtrong iron pins *G, G*, on the other end of which a nut is ſcrewed as tight as poſſible. Theſe two ſide pieces, as well as the beam, are pierced with as many mortiſes *H, H, H*, as it is intended to uſe coulters. The coulters ſhould fit the mortiſes as exactly as can be: and they ſhould be placed at ſuch diſtance from each other, that their points may form parallel lines three inches aſunder, in order to cut the turf into ſlips of that breadth, as at *I, I, I*.

1, 2, 3, are three coulters exactly alike, of which the blade *M, I*, ſhould be made of tough well hammer'd ſteel. Only three coulters are repreſented in this figure, in order to render it leſs confuſed: but if it is thought proper to uſe five coulters, by which means the work will be greatly expedited, two additional ones may eaſily be added, by making the pieces *F, F*, larger in proportion.

The beam is pierced with the two mortiſes *K, K*, in order to faſten it to the fore carriage of a common plough, by running the croſs ſtaves of that carriage, through thoſe mortiſes.*

The coulters are pierced with ſeveral holes, *viz.* at *L* and *M*, in order to raiſe them higher, or let them lower down: and they ſhould be of equal lengths below the beam, that all of them may enter equally deep into the ground. Beſides the pin which faſtens them at top, a wooden pin ſhould be ſtuck into the hole immediately below the beam, to prevent their being raiſed up by their preſſure upon the earth.

The draining of land is another great improvement to it: for tho' meadows and paſtures which are capable of being overflowed, produce a greater quantity of herbage than dry land; yet where the wet lies too long upon the ground, the graſs will be ſour and extremely coarſe;

* Having never ſeen one of theſe ploughs, it is with great deference that we would preſume to find the leaſt fault in what is propoſed by ſo accurate a gentleman as M. de Chateau-vieux. As this plough appears at preſent, too much ſeems to depend on the ſkill and dexterity of the plowman, to keep the coulters at a proper depth; there being no ſupport at the heel of the plough, to render it more ſteady, or take off the weight, and thereby leſſen the labour of the plowman. We would therefore propoſe, that an axle-tree ſhould paſs through the beam, near the inſertion of the handles, on which two wheels, proportioned to the length of the coulters, may turn at the diſtance of nine inches. This diſtance will be ſufficient to render the plough more ſteady, and theſe wheels will greatly leſſen the plowman's labour; and, running an inch and an half beyond the traces of the two outward coulters, if there are but three, and an inch and an half within the two outmoſt, in caſe there are five, they will not interfere with the intention of this operation.

coarſe; and if great care is not taken to drain this land, it will produce little graſs, but will ſoon be over-run with ruſhes and flags, ſo as to be of little value. The land which is moſt liable to this, is cold ſtiff clay, where the water cannot penetrate, but is contained as in a diſh; ſo that the wet which it receives in winter, continues till the heat of the ſun exhales it.

The beſt method for draining of theſe lands, is, as Mr. Miller adviſes, to cut ſeveral drains a-croſs the ground, as before directed by Mr. Worlidge, in thoſe places where the water is ſubject to lodge, and other ſmaller drains to carry it off from them, to either ponds or rivers in the lower parts of the land. Theſe drains need not be made very large, unleſs the ground be very low, and ſo ſituated as not to be near any river to which the water can be conveyed; in which caſe there ſhould be large ditches dug at proper diſtances, in the loweſt part of the ground, to contain the water; and the earth which comes out of the ditches, ſhould be equally ſpread on the land, to raiſe the ſurface. But where the water can be conveniently carried off, the beſt method is, to make under ground drains at proper diſtances, which may empty themſelves into large ditches, which are deſigned to carry off the water. Theſe ſort of drains are the moſt convenient, and no ground is loſt where they are made.

The uſual method of making them, is to dig trenches to a proper depth for carrying off the water, which, for the principal drains, ſhould be three feet wide at top, and ſloped down to a ſufficient depth. In theſe trenches, drains may be built in the manner of common ſewers, and covered over with the earth dug out of the trenches. Theſe drains ſhould be at leaſt a foot deep, and nearly as wide, that there may be room for the water to paſs through. The larger drains ſhould be at convenient diſtances, and ſmaller drains, of about ſix or ſeven inches wide, ſhould be cut a-croſs the ground, to diſcharge the water into thoſe larger drains. The number and ſituation of them ſhould be proportioned to the wetneſs of the land, and the depth of earth above the drains ſhould exceed a foot.

The beſt time of the year for making theſe drains is about Michaelmas, before the heavy rains of the winter begin to fall; becauſe at this ſeaſon of the year the land is uſually dry, ſo that the drains may be dug to a proper depth.

CHAP.

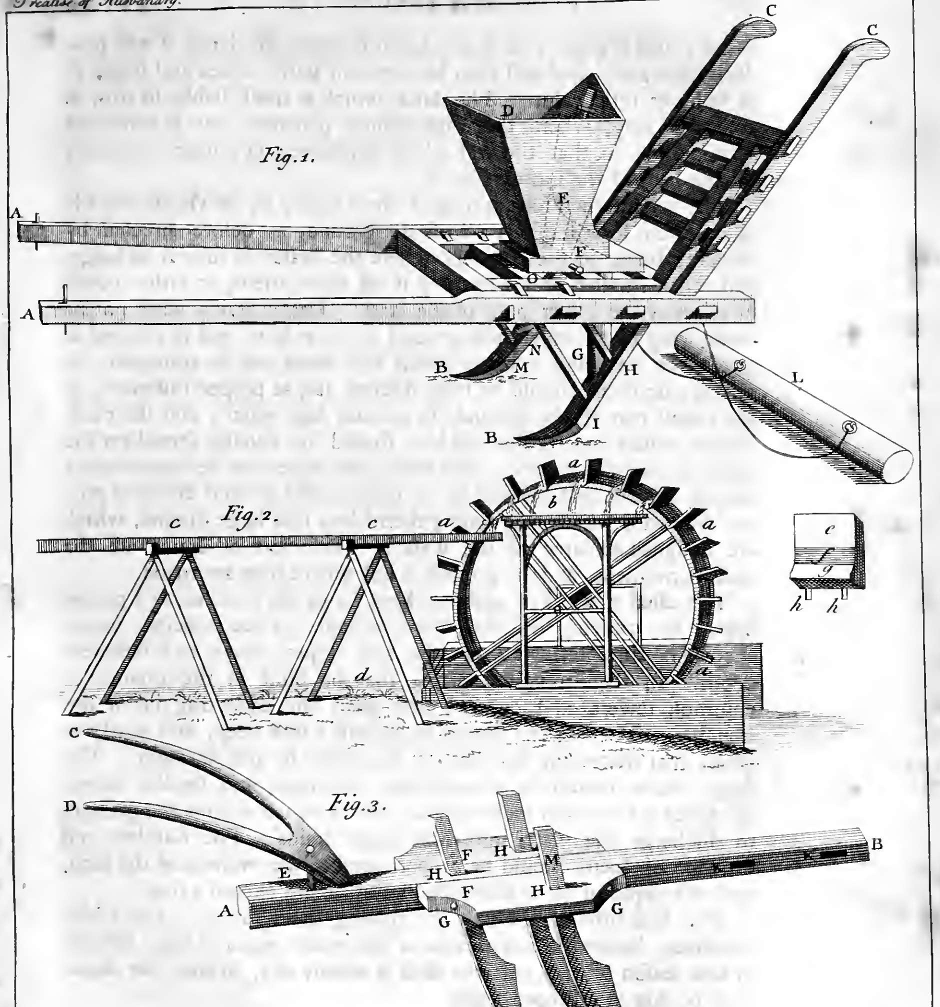
Fig. 1.
Fig. 2.
Fig. 3.
J. Mynde sc.

CHAP. XII.

Of the Culture of the Vine.

SECT. I.

WE shall here borrow Mr. Miller's judicious directions for the first planting of the vine, and then give the observations and experiments of Mess^rs de Chateau-vieux and Roussel, on the farther culture and management of it.

All sorts of vines are propagated either from layers or cuttings, the former of which is greatly practised in England, but the latter, says Mr. Miller, is what I would recommend, as being much preferable to the other: for the roots of vines do not grow strong and woody, as in most sorts of trees, but are long, slender, and pliable: therefore when they are taken out of the ground, they seldom strike out any fibres from the weak roots, which generally shrivel and dry, so that they rather retard than help the plants in their growth, by preventing the new fibres from putting out: for which reason, I had rather plant a good cutting than a rooted plant, provided it be well chosen; and there is little danger of its not growing.

But as there are few persons who make choice of proper cuttings, or at least that form their cuttings rightly in England; so it will be proper to give directions for this in the first place, before I proceed.

You should always make choice of such shoots as are strong and well ripened, of the last year's growth. These shoots should be cut from the old vine, just below the place where they were produced, taking a knot, or piece of the two years wood to each, which should be pruned smooth: those ends should then be laid into the ground about two inches deep, and the rest of the cuttings be left at full length, only observing to cover them with dry litter or peas-haulm in frosty dry weather; though in moist weather, the covering should not remain on, because it would make the cuttings grow, which would greatly injure them. In the spring, when they are to be planted, they should be taken out of the ground, and their upper part cut off, so as to reduce them to about fourteen inches in length, according to the distance of the buds or eyes: for those cuttings where buds grow pretty close together, need not be left more than one foot long; but on others fourteen or fifteen inches will be

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But as there are few perſons who make choice of proper cuttings, or at leaſt that form their cuttings rightly in England; ſo it will be proper to give directions for this in the firſt place, before I proceed.

You ſhould always make choice of ſuch ſhoots as are ſtrong and well ripened, of the laſt year's growth. Theſe ſhoots ſhould be cut from the old vine, juſt below the place where they were produced, taking a knot, or piece of the two years wood to each, which ſhould be pruned ſmooth: thoſe ends ſhould then be laid into the ground, about two inches deep, and the reſt of the cuttings be left at full length, only obſerving to cover them with dry litter or peaſe-haulm in froſty dry weather; though in moiſt weather, the covering ſhould not remain on, becauſe it would make the cuttings grow, which would greatly injure them. In the ſpring, when they are to be planted, they ſhould be taken out of the ground, and their upper part cut off, ſo as to reduce them to about fourteen inches in length, according to the diſtance of the buds or eyes: for thoſe cuttings where buds grow pretty cloſe together, need not be left more than one foot long; but on others, fourteen or fifteen inches will be full ſhort.

ſhort. The leaving the upper part of the ſhoots on all the winter, is of great ſervice to the cuttings: becauſe when they are cut off in autumn, the air penetrates the wounded part, and greatly injures the other eyes. In making the cuttings after this manner, there can be but one taken from each ſhoot; whereas moſt perſons cut them into lengths of about a foot, and plant them all, which is very wrong: for the upper part of the ſhoots are never ſo well ripened as the lower, which was produced early in the ſpring, and has had the whole ſummer to harden; ſo that if they take root, they never make ſo good plants; for the wood of thoſe cuttings being ſpongy and ſoft, admits the moiſture too freely, whereby the plants will be luxuriant in growth, but never ſo fruitful as thoſe whoſe wood is cloſer and more compact.

The cuttings may remain in the ground till the beginning of April, (which is the beſt time for planting them,) when you ſhould take them out, and waſh them from the filth they have contracted, and if you find them very dry, you ſhould let them ſtand with their lower parts in water, ſix or eight hours, which will diſtend their veſſels, and diſpoſe them for taking root. Then the ground being before prepared where the plants are deſigned to remain, whether againſt walls, or for ſtandards, (for they ſhould not be removed again,) the cuttings ſhould be planted: but in preparing the ground, you ſhould conſider the nature of the ſoil, which, if ſtrong, and inclinable to wet, is by no means proper for grapes: therefore where it ſo happens, you ſhould open a trench where the cuttings are to be planted, which ſhould be filled with lime rubbiſh, the better to drain off the moiſture: then raiſe the border with freſh light earth about two feet thick, ſo that it may be at leaſt a foot above the level of the ground: then you ſhould open the holes at about ſix feet diſtance from each other, putting one good ſtrong cutting into each hole, in which it ſhould be laid a little ſloping, and ſo deep, as that the uppermoſt eye may be level with the ſurface of the ground: for when any part of the cutting is left above ground, as is the common method uſed by the Engliſh gardeners, moſt of the buds attempt to ſhoot; ſo that the ſtrength of the cutting is divided to nouriſh ſo many ſhoots, which muſt conſequently be weaker than if only one of them grew: whereas, on the contrary, by burying the whole cutting in the ground, the ſap is all employed in one ſingle ſhoot, which conſequently will be much ſtronger: beſides, the ſun and air

are

are apt to dry that part of the cutting which remains above ground, which often prevents their buds from ſhooting.

Having plac'd the cutting in the ground, you ſhould fill up the hole, gently preſſing down the earth with your foot cloſe about it, and raiſe a little hill juſt upon the top of the cutting, to cover the upper eye quite over, which will prevent it from drying. This being done, there is nothing more neceſſary, but to keep the ground clear from weeds, until the cuttings begin to ſhoot; at which time you ſhould look them over carefully, to rub off any ſmall ſhoots, if ſuch are produced, leaving only the firſt main ſhoot to the wall; which ſhould be conſtantly trained up, as it extends in length, to prevent its breaking, or hanging down. You muſt continue to look over theſe once in about three weeks during the ſummer ſeaſon, conſtantly rubbing off all lateral ſhoots which are produced, leaving only the firſt main ſhoot: and be ſure to keep the ground conſtantly clear from weeds, which, if ſuffered to grow, will exhauſt the goodneſs of the ſoil, and ſtarve the cuttings.

The Michaelmas following, if your cuttings have produced ſtrong ſhoots, you ſhould prune them down to two eyes, which, though by ſome people may be thought too ſhort, yet I am ſatisfied, from ſeveral experiments, to be the beſt method. The reaſon for adviſing the pruning of vines at this ſeaſon, rather than deferring it till ſpring, is, becauſe the tender parts of thoſe young ſhoots, if left on, are ſubject to decay in winter; for they are apt to grow late in the year; ſo the tops of their ſhoots are tender, and the early froſts will pinch them, and then they frequently are killed down a conſiderable length, which weakens their roots: but if they are cut off early in autumn, the wounds will heal over before the bad weather, and thereby the roots will be greatly ſtrengthened.

In the ſpring, after the cold weather is paſt, you muſt gently dig up the borders, to looſen the earth: but you muſt be very careful in doing this, not to injure the roots of your vines. You ſhould alſo raiſe the earth up to the ſtems of the plants, ſo as to cover the old wood, but not ſo deep as to cover either of the eyes of the laſt year's wood. After this, they will require no farther care until they begin to ſhoot, when you ſhould look over them carefully, to rub off all weak dangling ſhoots, leaving no more than the two ſhoots, which are produced from the two eyes of the laſt year's wood, which ſhould be faſtened to the wall; and ſo from this, until the vines have done ſhooting, you ſhould look them over once in three weeks or a month, to rub off all lateral ſhoots as they are produced; and to faſten the main ſhoots to the wall, as they are extended in length, which muſt not be ſhortened before the middle, or latter end of July, when it will be proper to nip off their tops, which will ſtrengthen the lower eyes: and during the ſummer ſeaſon, you muſt conſtantly keep the ground clear from weeds: nor ſhould you permit any ſort of plants to grow near the vines; which would not only rob them of nouriſhment, but ſhade the lower parts of the ſhoots, and thereby prevent their ripening; which will not only cauſe their wood to be ſpongy and luxuriant, but render it leſs fruitful.

As ſoon as the leaves begin to drop in autumn, you ſhould prune theſe young vines again, leaving three buds to each of the ſhoots, provided they are ſtrong: otherwiſe it is better to ſhorten them down to two eyes, if they are good; for it is a very wrong practice to leave much wood upon young vines, or to leave their ſhoots too long, which greatly weakens the roots: then you ſhould faſten them to the wall, ſpreading them out horizontally each way, that there may be room to train the new ſhoots the following ſummer; and in the ſpring, dig the borders as before.

The third ſeaſon, you muſt go over the vines again, as ſoon as they begin to ſhoot, to rub off all danglers as before; and train the young ſhoots in their proper places, which this year may be ſuppoſed to be two from each ſhoot of the laſt year's wood: but if they attempt to produce two ſhoots from one eye, the weakeſt of them muſt be rubbed off; for there ſhould never be more than one allowed to come out of each eye. If any of them produce fruit, as many times they will the third year, you ſhould not ſtop them ſo ſoon as is generally practiſed upon the bearing ſhoots of old vines, but permit them to ſhoot forward till a month after Midſummer, at which time you may pinch off the tops of the ſhoots: for if this were done too ſoon, it would ſpoil the buds for the next year's wood, which in young vines muſt be more carefully preſerved than on older plants, becauſe there are no other ſhoots to be laid in for a ſupply of wood, as is commonly practiſed on old vines.

During the ſummer, you muſt conſtantly go over your vines, and diſplace all weak lateral ſhoots as they are produced, and carefully keep the ground clear from weeds, as was before directed, that the ſhoots may ripen well; which is a material thing to be obſerved in moſt ſorts of fruit trees, but eſpecially in vines, which ſeldom produce any fruit from immature branches. Theſe things, being duly obſerved, are all that is neceſſary in the management of young vines. I ſhall therefore proceed to lay down rules for the government of grown vines, which I ſhall do as briefly as poſſible.

Vines ſeldom produce any bearing ſhoots from wood that is more than one year old: therefore great care ſhould be taken to have ſuch wood in every part of the trees: for the fruit is always produced upon ſhoots of the ſame year, which come out from buds of the laſt year's wood. The method commonly practiſed by the gardeners in England is, to ſhorten the branches of the former year's growth, down to three or four eyes, at the time of pruning; though there are ſome perſons who leave theſe ſhoots much longer, and affirm that by this practice they obtain a greater quantity of fruit: but however this may be, it is a very wrong practice; ſince it is impoſſible that one ſhoot can nouriſh forty or fifty bunches of grapes, ſo well as it can ten or twelve; ſo that what is gotten in numbers, is loſt in their magnitude. Beſides, the greater quantity of fruit there is left on vines, the later it is ripened, and the juice is not ſo rich. This is ſo well known in the wine countries, that there are laws enacted to direct the number and length of ſhoots that are to be left upon each vine; leſt by over-bearing them, they not only exhauſt and weaken the roots, but thereby render the juice weak, and ſo deſtroy the reputation of their wine.

The beſt method therefore is, to ſhorten the bearing ſhoots, to about four eyes in length, becauſe the lowermoſt ſeldom is good, and three buds are ſufficient: for each of theſe will produce a ſhoot, which generally has two or three bunches of grapes: ſo that from each of thoſe ſhoots there may be expected ſix or eight bunches, which are a ſufficient quantity. Theſe ſhoots muſt be laid about eighteen inches aſunder: for if they are cloſer, when the ſide ſhoots are produced, there will not be room enough to train them againſt the wall, which ſhould always be provided for: and as their leaves are very large, the branches ſhould be left at a proportionable diſtance from each other, that they may not croud or ſhade the fruit.

At the winter pruning of your vines, you ſhould always obſerve to make the cut juſt above the eye, ſlopeing it backward from it, that if it ſhould bleed, the ſap may not flow upon the bud: and where there is an opportunity of cutting down ſome young ſhoots to two eyes, in order to produce vigorous ſhoots for the next year's bearing, it ſhould always be done: becauſe in ſtopping of thoſe ſhoots which have fruit upon them as ſoon as the grapes are formed, which is frequently practiſed, it often ſpoils the eyes for producing bearing branches the following year; and this reſerving of new wood, is what the vine dreſſers abroad always practiſe in their vineyards. The beſt ſeaſon for pruning of vines, is about the middle or end of October.

The latter end of April, or the beginning of May, when the vines begin to ſhoot, you muſt carefully look them over, rubbing off all ſmall buds which may come from the old wood, which only produce weak dangling branches: as alſo when two ſhoots are produced from the ſame bud, the weakeſt of them ſhould be diſplaced, which will cauſe the others to be ſtronger; and the ſooner this is done, the better it is for the vines.

In the middle of May, you muſt go over them again, rubbing off all the dangling ſhoots, as before; and at the ſame time you muſt faſten up all the ſtrong branches, ſo that they may not hang from the wall: for if their ſhoots hang down, their leaves will be turned with their upper ſurfaces the wrong way, and when the ſhoots are afterwards trained upright, they will have their under ſurface upward, and until leaves are turned again, and have taken their right poſition, the fruit will not thrive; ſo that the not obſerving this management will cauſe the grapes to be a fortnight or three weeks later before they ripen: beſides, by ſuffering the fruit to hang from the wall, and be ſhaded with the cloſeneſs of the branches, it is greatly retarded in its growth: therefore, during the growing ſeaſon, you ſhould conſtantly look over the vines, diſplacing all dangling branches and wild wood, and faſten up the other ſhoots regularly to the wall, as they are extended in length; and towards the middle of June, you ſhould ſtop the bearing branches, which will ſtrengthen the fruit, provided you always leave three eyes above the bunches: for if you ſtop them too ſoon, it will injure the fruit, by taking away that part of the branch which is neceſſary to attract the nouriſhment to the fruit, as alſo to perſpire off the crudities of the ſap, which is not proper for the fruit to receive.

But although I recommend the ſtopping thoſe ſhoots which have fruit, at this ſeaſon, yet this is not to be practiſed upon thoſe which are intended for bearing the next year; for theſe muſt not be ſtopped before the middle of July, leſt, by ſtopping them too ſoon, you cause the eyes to shoot out strong lateral branches, whereby they will be greatly injured.

During the summer season, you should be very careful to rub off all dangling branches, and train up the shoots regularly to the wall, as before, which will greatly accelerate the growth of the fruit, and also admit the sun and air, which is absolutely necessary to ripen and give it a rich flavour: but you must never divest the branches of their leaves, as is the practice of some persons; for although the admitting of the sun is necessary to ripen the grapes, yet if they are too much exposed thereto, their skins will be tough, and they will rarely ripen: besides, the leaves being absolutely necessary to nourish the fruit, by taking them off, the fruit is starved, and seldom comes to any size: therefore a great regard should be had to the summer management of the vines, where persons are desirous to have their fruit excellent, and duly ripened.

When all the fruit is gathered, you should prune the vines, whereby the litter of their leaves will be entirely removed at once, and their fruit will be the forwarder the succeeding year.

For the farther culture of the vine, in gardens, and in the different countries of Europe, we refer the curious to the article *Vitis* in Mr. Miller's Gardener's Dictionary, and shall proceed to give that gentleman's directions for the management,

SECTION II.

Of Vineyards in England.

"THERE have of late years been but very few vineyards in "England, though they were formerly very common, as may "be gathered from the several places in divers parts of England "which yet retain that name, as also from antient records, which "testify the quantities of ground which were allotted for vineyards, "to abbeys and monasteries, for wine for the use of the inhabitants; "but as to the quality of the wines which were then produced in "England, we are at present ignorant; and how these vineyards "were rooted up, and became so generally neglected, we have no "very good accounts left. Whatever might be the cause of this total "neglect in cultivating vines in England, I will not pretend to determine, but such was the prejudice most people conceived to any "attempts of producing wine in England, that, for some ages past, "every trial of that kind has been ridiculed by the generality of

" people,

" people, and at this day very few perſons will believe it poſſible to
" be effected.

" Indeed if we judge only by the ſucceſs of ſome modern eſſays " made near London, where ſmall vineyards have been planted a " few years paſt, there would be no great encouragement to begin a " work of this kind, becauſe the produce of very few of theſe vine- " yards has been ſo kindly as were to be wiſhed, but however, this " ſhould not deter others from making farther trials, eſpecially when " they conſider the many diſadvantages, which moſt or all of thoſe " plantations which have been made, were attended with, for firſt " there is ſcarce one of them placed upon a proper ſoil and ſituation " for this purpoſe; and ſecondly, there is not one which is rightly " planted and managed, as I ſhall preſently ſhew: and how can we " expect ſucceſs from vineyards under theſe diſadvantages, when even " in France or Italy they would ſucceed little better, if their ma- " nagement were not directed with more judgment? I ſhall therefore " humbly offer my opinion, which is founded upon ſome trials " I have ſeen made, and from the inſtructions that I have received " from ſeveral curious perſons abroad, who cultivate vineyards for " their own uſe, and that of their friends, and who have been very " exact in obſerving the ſeveral methods of practice amongſt the *Vig- " nerons* of thoſe countries, from whence it is hoped that the preju- " dice, which moſt people have againſt a project of this kind, will " either be removed, or at leaſt ſuſpended, until trials have been ju- " diciouſly made of this affair.

" The firſt and great things to be conſidered in planting vineyards " is the choice of ſoils and ſituations, which, if not rightly choſen, " there will be little hopes of ſucceſs, for upon this the whole affair " greatly depends. The beſt ſoil for a vineyard in England is ſuch, " whoſe ſurface is a light ſandy loam, and not above a foot and a " half or two feet deep above the gravel or chalk, either of which " bottoms are equally good for vines, but if the ſoil is deep, and the " bottom either clay, or a ſtrong loam, it is by no means proper for " this purpoſe, for although the vines may ſhoot vigorouſly, and pro- " duce a great quantity of grapes, yet theſe will be later ripe, fuller of " moiſture, and ſo conſequently their juice not mature, nor well di- " geſted, but will abound with crudity, which in fermenting will " render the wine ſour and ill taſted, which is the common com- " plaint of thoſe who have made wine in England.

" Nor is a very rich, light, deep ſoil, ſuch as is commonly found

" near

" near London, proper for this purpoſe; becauſe the roots of theſe " vines will be enticed down too deep to receive the influences of the " ſun and air, and hereby will take in much crude nouriſhment, whereby the fruit will be rendered leſs valuable, and be later ripe, which is " of ill conſequence to theſe fruits, which are known to imbibe a " great ſhare of their nouriſhment from the air, which, if replete with " moiſture (as is commonly the caſe in autumn), muſt neceſſarily " contribute greatly to render the juices leſs perfect: therefore great " attention ſhould be had to the nature of the ſoil upon which they " are planted.

" The next thing neceſſary to be conſidered, is the ſituation of the " place, which, if poſſible, ſhould be on the north ſide of a river, upon " an elevation inclining to the ſouth, with a ſmall gradual deſcent, " that the moiſture may the better drain off, but if the ground ſlopes " too much, it is by no means proper for this purpoſe: but if, at a " diſtance from this place, there are larger hills, which defend it " from the north and north-weſt wind, it will be of great ſervice; " becauſe hereby the ſun's rays will be reflected with a greater force, " and the cold winds, being kept off, will render the ſituation very " warm. Add to this, a chalky ſurface; which if thoſe hills do " abound with (as there are many ſuch ſituations in England), it " will ſtill add to the heat of the place, by reflecting a greater quantity of the ſun's rays.

" The country about this ſhould be open and hilly: for if it be " much planted, or low and boggy, the air will be conſtantly filled " with moiſt particles, occaſioned by the plentiful perſpiration of the " trees, or the exhalations from the adjoining marſhes, whereby the " fruit will be greatly prejudiced (as was before obſerved). Theſe " vineyards ſhould always be open to the eaſt, that the morning ſun " may come on them to dry off the moiſture of the night early, " which, by lying too long upon the vines, greatly retards the ripening of the fruit, and renders it crude and ill taſted. And ſince the " fruit of vines is rarely ever injured by eaſterly winds, there will " be no reaſon to apprehend any danger from ſuch a ſituation, the " ſouth weſt, north weſt, and north winds being the moſt injurious " to vineyards in England (as indeed they are to moſt other fruit), " ſo that, if poſſible, they ſhould be ſheltered therefrom.

" Having made choice of a ſoil and ſituation proper for this purpoſe, the next thing to be done is, to prepare it for planting: in " doing of which the following method ſhould be obſerved: in the

" ſpring

" ſpring, it ſhould be plowed as deep as the ſurface will admit, turn-
" ing the ſward into the bottom of each furrow: then it ſhould be
" well harrowed, to break the clods, and cleanſe it from the roots of
" noxious weeds; and after this, it muſt be kept conſtantly ploughed
" and harrowed for at leaſt one year, to render the ſurface light;
" and hereby it will be rendered fertile, by imbibing the nitrous par-
" ticles of the air (eſpecially if it be long expoſed thereto before it is
" planted): then in March the ground ſhould be well plowed again,
" and after having made the ſurface pretty even, the rows ſhould be
" marked out from ſouth-eaſt to north-weſt, at the diſtance of ten
" feet from each other; and theſe rows ſhould be croſſed again at
" five or ſix feet diſtance, which will mark out the exact places
" where each plant ſhould be placed, ſo that the vines will be ten
" feet row from row, and five or ſix feet aſunder in the rows, nearer
" than which they ought never to be planted. And herein moſt
" people, who have planted vineyards, have greatly erred, ſome
" having allowed no more than five feet from row to row, and the
" plants but three feet aſunder in the rows; and others, who think
" they have been full liberal in this article, have only planted their
" vines at ſix feet diſtance every way: but neither of theſe have al-
" lowed a proper diſtance to them, as I ſhall ſhew: for, in the firſt
" place, where the rows are placed too cloſe, there will not be room
" for the ſun and air to paſs in between them to dry up the moiſture,
" which, being detained amongſt the vines, muſt produce very ill
" effects: and, ſecondly, where the vines are placed in exact ſquares,
" ſo near together as ſix feet, there can be no room for the current
" of air to paſs between them, when their branches are extended
" on each ſide, and ſo conſequently the damps in autumn will be en-
" tangled and detained amongſt the vines, to the great prejudice of
" their fruit: for ſince the autumns in England are often attended
" with rains, cold dews, or fogs, all proper care ſhould be taken to
" remove every thing that may obſtruct the drying up the damps
" which ariſe from the ground.

" The ſkilful *Vignerons* abroad are alſo ſenſible how much it con-
" tributes to the goodneſs of their vines to allow a large ſpace between
" the rows; and therefore where the quality of the wine is more
" regarded than the quantity, there they never plant their vines at
" leſs than ten feet row from row, and ſome allow twelve. It was an
" obſervation of Bellonius, almoſt two hundred years ſince, that in
" thoſe iſlands of the Archipelago, where the rows of vines were
" placed

" placed at a greater diſtance, the wine was much preferable to
" thoſe which were cloſe planted; and this he poſitively affirms to
" be the caſe in moſt countries where he had travelled. Indeed we
" need not have recourſe to antiquity for the certainty of ſuch facts,
" when we are daily convinced of this truth in all cloſe plantations
" of any kind of fruit, where it is conſtantly obſerved, that the
" fruits in ſuch places are never ſo well coloured, ſo early ripe, nor
" near ſo well flavoured, as thoſe produced on trees, where the air
" can freely circulate about them, and the rays of the ſun have free
" acceſs to the branches, whereby the juices are better prepared be-
" fore they enter the fruit.

" Having thus conſidered the diſtance which is neceſſary to be al-
" lowed to theſe plants, we come next to the planting: but in order
" to this, the proper ſorts of grapes ſhould be judiciouſly choſen;
" and in this particular, we have egregiouſly erred in England. All
" the vineyards at preſent planted here, are of the ſweeteſt and beſt
" ſort of grapes for eating, which is contrary to the general practice
" of the *Vignerons* abroad, who always obſerve, that ſuch grapes
" never make good wine; and therefore, from experience, make
" choice of thoſe ſorts of grapes, whoſe juice, after fermenting,
" affords a noble rich liquor; which grapes are always obſerved to
" be auſtere, and not by any means palatable. This is alſo agreable
" to the conſtant practice of our cyder-makers in England, who
" always obſerve that the beſt eating apples make but poor cyder;
" whereas the more rough and auſtere ſorts, after being preſſed and
" fermented, afford a ſtrong vinous liquor. And I believe it will be
" found true in all fruits, that where the natural heat of the ſun
" ripens and prepares their juices, ſo as to render them palatable,
" whatever degree of heat theſe juices have more, either by fermen-
" tation, or from any other cauſe, will render them weaker, and leſs
" ſpirituous. Of this we have many inſtances in fruits: for if we
" tranſplant any of our ſummer or autumn fruits, which ripen per-
" fectly in England without the aſſiſtance of art, into a climate a
" few degrees warmer, theſe fruits will be mealy and inſipid; ſo
" likewiſe if we bake or ſtew any of theſe fruits, they will be good
" for little, loſing all their ſpirit and flavour by the additional heat of
" the fire; and ſuch fruits as are by no means eatable raw, are here-
" by rendered exquiſite, which, if tranſplanted into a warmer cli-
" mate, have, by the additional heat of the ſun, been alſo altered ſo
" as to exceed the moſt delicious of our fruit in this country.

" From whence it is plain, that thoſe grapes which are agreable " to the palate for eating, are not proper for wine; in making of " which, their juices muſt undergo a ſtrong fermentation: there- " fore, ſince we have in England been only propagating the moſt " palatable grapes for eating, and neglected the other ſorts, before " we plant vineyards, we ſhould take care to be provided with " the proper ſorts from abroad, which ſhould be choſen according " to the ſort of wines intended to be imitated; though I believe the " moſt probable ſort to ſucceed in England, is the Auvernat, or " true Burgundy grape, (which is at preſent very rare to be found " in the Engliſh vineyards; though it is a common grape in the " gardens, againſt walls). This ſort of grape is moſt preferred in " Burgundy, Champaign, Orleans, and moſt of the other wine coun- " tries in France; and I am informed, that it ſucceeds very well in " ſeveral places to the north of Paris, where proper care is taken of " their management: ſo that I ſhould adviſe ſuch perſons as would " try the ſucceſs of vineyards in England, to procure cuttings of this " grape from thoſe countries: but herein ſome perſon of integrity " and judgment ſhould be employed to get them from ſuch vine- " yards where no other ſorts of grapes are cultivated; which is very " rare to find, unleſs in ſome particular vineyards of the citizens, " who are very exact to keep up the reputation of their wines; no- " thing being more common than for the *Vignerons* to plant three or " four ſorts of grapes in the ſame vineyard, and at the time of vin- " tage to mix them all together; which renders their wines " leſs delicate than in ſuch places where they have only this one true " ſort of grape. And here I would caution every one againſt mix- " ing the juice of ſeveral grapes together, which will cauſe the wine " to ferment at different times, and in different manners.

" The cuttings being thus provided, (for I would always prefer " theſe to layers, or rooted plants,) about the beginning of April is the " beſt ſeaſon for planting; when it will be proper to put the lower ends " of the cuttings in water about three inches, ſetting them upright, " for ſix or eight hours before they are uſed; then at the center of " every croſs mark already made by a line, to the diſtance the vines " are deſigned, ſhould be a hole made with a ſpade, or other inſtru- " ment, about a foot deep, into each of which ſhould be put one " ſtrong cutting, placing it a little ſloping: then the hole ſhould be " filled up with earth, preſſing it gently with the foot to the cut-

" ting,

" ting, and raiſing a little hill to each about three inches, ſo as juſt
" to cover the uppermoſt eye or bud, which will prevent the wind
" and ſun from drying any part of the cuttings, and this upper eye
" only will ſhoot; the under ones moſt of them will puſh out roots,
" ſo that this ſhoot will be very ſtrong and vigorous.

" After they are thus planted, they will require no other care un-
" til they ſhoot, except to keep the ground clear from weeds, which
" ſhould be conſtantly obſerved: but as the diſtance between the rows
" of vines is very great, ſo the ground between them may be ſown
" or planted with any kind of eſculent plants, which do not grow
" tall, provided there is proper diſtance left from the vines, and
" care taken that the vines are not injured by the crops, or in the
" gathering, and carrying them off the ground; and this huſbandry
" may be continued three or four years, till the vines come to bear-
" ing; after which time there ſhould be no ſort of crop put between
" them in ſummer; becauſe the cleaner the ground is kept between
" the vines, from weeds or plants, the more heat will be reflected to
" the grapes; but after the grapes are gathered, there may be a crop
" of coleworts for ſpring uſe, planted between the rows of vines, and
" the cultivating theſe will be of uſe to the vines, by ſtirring of the
" ground: but as to watering, or any other trouble, there will be
" no occaſion for it, notwithſtanding what ſome people have di-
" rected; for in England there is no danger of their miſcarrying by
" drought. When the cuttings begin to ſhoot, there ſhould be a
" ſmall ſtick of about three feet long ſtuck down by each, to which
" the ſhoots ſhould be faſtened, to prevent their breaking or lying on
" the ground, ſo that as the ſhoots advance, the faſtening ſhould
" be renewed, and all ſmall lateral ſhoots (if there are any ſuch pro-
" duced) ſhould be conſtantly diſplaced, and the ground between
" the vines always kept clean. This is the whole management
" which is required the firſt ſummer.

" But at Michaelmas, when the vines have done ſhooting, they
" ſhould be pruned; for if they are left unpruned till ſpring, their
" ſhoots being tender (eſpecially toward their upper parts) will be in
" danger of ſuffering if the winter ſhould prove ſevere.

" This pruning is only to cut down the ſhoots to two eyes; and
" if, after this is done, the earth be drawn up in a hill about each
" plant, it will ſtill be a greater defence againſt froſt.

" At the beginning of March, the ground between the vines ſhould
" be well dug, to looſen it, and render it clean: but you ſhould be

" careful not to dig deep cloſe to the vines, leſt thereby their roots " ſhould be cut or bruiſed; and at the ſame time the earth ſhould " be again laid up in a hill about each plant: but there muſt be care " taken not to bury the two young eyes of the former year's ſhoot, " which were left to produce new wood.

" At the beginning of May, when the vines are ſhooting, there " ſhould be two ſtakes fixed down to the ſide of each plant, which " muſt be ſomewhat taller and ſtronger than thoſe of the former " year; to theſe the two ſhoots (if ſo many are produced) ſhould " be faſtened, and all the ſmall trailing or lateral ſhoots ſhould be " conſtantly diſplaced, that the other ſhoots may be ſtronger; and " the ground ſhould alſo be kept very clear from weeds as be- " fore.

" The autumn following theſe vines ſhould be pruned again in " the following manner: thoſe of them which have produced two " ſtrong ſhoots of equal vigour, muſt be cut down to three eyes " each; but in ſuch as have one ſtrong ſhoot and a weak one, the " ſtrong one muſt be ſhortened to three eyes, and the weak one to " two; and ſuch vines as have produced but one ſtrong ſhoot, " ſhould be ſhortened down to two eyes alſo, in order to obtain " more wood againſt the ſucceeding year.

" In the ſpring, about the beginning of March, the ground be- " tween the vines ſhould be again dug, as before, and two ſtakes " ſhould be placed down by the ſide of all ſuch vines as have two " ſhoots, at ſuch diſtance on each ſide of the plant as the ſhoots " will admit to be faſtened thereto, and the ſhoots ſhould be drawn " out on each ſide to the ſtakes, ſo as to make an angle of about " forty-five degrees with the ſtem; but by no means ſhould they " be bent down horizontally, as is by ſome practiſed: for the " branches lying too near the earth, are generally injured by the " damps which ariſe from thence, but eſpecially when they have " fruit, which is never ſo well taſted, nor ſo early ripe upon thoſe " branches, as when they are a little more elevated.

" In May, when the vines begin to ſhoot, they muſt be carefully " looked over, and all the weak dangling ſhoots ſhould be rubbed " off as they are produced, and thoſe ſhoots which are produced " from ſtrong eyes, ſhould be faſtened to the ſtakes to prevent their " being broken off by the wind.

" This management ſhould be repeated at leaſt every three weeks, " from the beginning of May to the end of July; by which means

" the ſhoots which are trained up for the ſucceeding year, will not " only be ſtronger, but alſo better ripened and prepared for bearing; " becauſe they will have the advantage of ſun and air, which is ab- " ſolutely neceſſary to prepare their juices: whereas if they are " crouded by a number of ſmall dangling weak branches, they will " ſhade and exclude the rays of the ſun from the other ſhoots; and " ſo by detaining the moiſture a longer time amongſt the branches, " occaſion the veſſels of the young wood to be of a larger dimen- " ſion; and hereby the crude juice finds an eaſy paſſage through " them; ſo that the ſhoots in autumn ſeem to be moſtly pith, and " are of a greeniſh immature nature, and wherever this is obſerved, " it is a ſure ſign of a bad quality in the vines.

" The ſoil alſo ſhould be conſtantly kept clean, becauſe, if there " are any vegetables (either weeds or plants of other kinds) growing " between the vines, it will detain the dews longer, and by their " perſpiration, occaſion a greater moiſture, than would be, if the " ground were entirely clear; ſo that thoſe who plant other things " between their rows of vines, are guilty of a great error.

" In autumn, the vines ſhould be pruned, which ſeaſon I " approve of rather than the ſpring: and this being the third " year from planting, the vines will now be ſtrong enough to pro- " duce fruit, therefore they muſt be pruned accordingly. Now " ſuppoſe the two ſhoots of the former year, which were ſhortened " to three eyes, have each of them produced two ſtrong branches " the ſummer paſt, then the uppermoſt of theſe ſhoots upon each " branch ſhould be ſhortened down to three good eyes (never in- " cluding the lower eye, which is ſituate juſt above the former " year's wood, which ſeldom produces any thing, except a weak " dangling ſhoot); and the lower ſhoots ſhould be ſhortened down " to two good eyes each; theſe being deſigned to produce vigorous " ſhoots for the ſucceeding year; and the former are deſigned to bear " fruit; but where the vines are weak, and have not produced more " than two or three ſhoots the laſt ſeaſon, there ſhould be but one " of them left with three eyes for bearing; the other muſt be " ſhortened down to two, or if weak to one good eye, in order to " obtain ſtrong ſhoots the following ſummer, for there is nothing " more injurious to vines, than the leaving too much wood upon " them, eſpecially while they are young; or the overbearing them, " which will weaken them ſo much, as not to be recovered again to

" a good

" a good ſtate in ſeveral years; though they ſhould be managed with
" all poſſible ſkill.

" In March, the ground between the vines ſhould be well dug as
" before, obſerving not to injure their roots by digging too deep near
" them: but where there are ſmall horizontal roots produced on or
" near the ſurface of the ground, they ſhould be pruned off cloſe to
" the places where they were produced; theſe being what the *vigne-*
" *rons* call day roots, and are by no means neceſſary to be left on: and
" after having dug the ground, the ſtake ſhould be placed down in
" the following manner: on each ſide of the vine ſhould be a ſtake
" put in at about ſixteen inches from the root, to which the two
" branches, which were pruned to three eyes, each for bearing,
" ſhould be faſtened, (obſerving, as was before directed, not to draw
" them down too horizontally); then another taller ſtake ſhould be
" placed down near the foot of the vine, to which the two ſhoots
" which were pruned down to two eyes, ſhould be faſtened, pro-
" vided they are long enough for that purpoſe: but if not, when
" their eyes begin to ſhoot, theſe muſt be trained upright to the
" ſtakes, to prevent their trailing on the ground, hanging over the
" fruit branches, or being broken by the wind.

" In May, the vines ſhould be carefully looked over again, at
" which time all weak lateral branches ſhould be rubbed off as they
" are produced; and thoſe ſhoots which ſhew fruit, muſt be faſtened
" with baſs to the ſtakes to prevent their being broken, until they are
" extended to three joints beyond the fruit, when they ſhould be
" ſtopped: but the ſhoots which are deſigned for bearing the follow-
" ing ſeaſon, ſhould be trained upright to the middle ſtake, by
" which method the fruit branches will not ſhade theſe middle
" ſhoots, nor will the middle ſhoots ſhade the fruit, ſo that each
" will enjoy the benefit of ſun and air.

" This method ſhould be repeated every fortnight or three weeks,
" from the beginning of May, to the middle of July, which will al-
" ways keep the ſhoots in their right poſition, whereby the leaves
" will not be inverted, which greatly retards the growth of the fruit;
" and by keeping the vines conſtantly clear from horizontal ſhoots,
" the fruit will not be crouded with leaves or ſhaded, but will have
" conſtantly the advantage of the ſun and air equally, which is of
" great conſequence: for where the fruit is covered with theſe dang-
" ling ſhoots in the ſpring, and are afterwards expoſed to the air,
" either by diveſting them of their leaves, or elſe diſplacing their
" branches

" branches entirely, as is often practifed, the fruit will become hard,
" and remain at a perfect ftand for three weeks, and fometimes will
" never advance afterward, as I have feveral times obferved: there-
" fore there cannot be too much care taken to keep them conftantly
" in a kindly ftate of growth, as the *vignerons* abroad well know,
" though in England it is little regarded by the generality of garden-
" ers, who, when their grapes fuffer by this neglect, immediately
" complain of the climate, or the untowardnefs of the feafon, which
" is too often a cover for neglects of this nature. And here I can-
" not help taking notice of the abfurd practice of thofe who pull off
" the leaves from their vines, which are placed near the fruit: in
" order to let in the rays of the fun to ripen them; not confidering
" how much they expofe their fruit to the cold dews, which fall
" plentifully in autumn, which, being imbibed by the fruit, greatly
" retard it: befides, no fruit will ripen fo well when entirely
" expofed to the fun, as when it is gently fcreened with leaves:
" and by the pulling off thefe leaves, which are abfolutely neceffary
" to prepare the juices before they enter the fruit, the grofs parts of
" which are perfpired away by the leaves, the fruit muft either be
" deprived of nourifhment, or elfe fome of the grofs particles will
" enter with the more refined parts of the juice, and thereby render
" the fruit worfe than it would otherwife be, were the leaves
" permitted to remain upon the branches: for if the weak dang-
" ling fhoots are conftantly difplaced as they are produced, the fruit
" will not be too much fhaded by the leaves that are upon the bear-
" ing branches.

" When the fruit is ripe, if the ftalks of the bunches are cut
" half through a fortnight before they are gathered, it will caufe
" the juice to be much better, becaufe there will not be near fo
" great a quantity of nourifhment enter the fruit, whereby the
" watery particles will have time to evaporate, and the juice will be
" better digefted. This is practifed by fome of the moft curious
" *Vignerons* in the South of France, where they make excellent wine.
" But if, after the branches are cut, they are hung up in a dry room
" upon ftrings, fo as not to touch each other, for a month before
" they are preffed; it will alfo add greatly to the ftrength of the
" wine; becaufe in that time a great quantity of the watery parts of
" the juices will evaporate. This is a conftant practice with fome
" perfons who inhabit the Tirolefe, on the borders of Italy, where
" is made a moft delicious rich wine, as hath been attefted by
" Dr,

"Dr. Burnet in his travels; and I have heard the ſame from ſeve-
"ral gentlemen, who have travelled that road ſince.

"But with all the care that can poſſibly be taken, either in the "culture of the vines, or in making the wine, it will not be near "ſo good while the vineyard is young, as it will be after it has been "planted ten or twelve years; and it will be conſtantly mending, "until it is fifty years old, as is atteſted by ſeveral curious perſons "abroad, as alſo by the moſt ſkilful wine-coopers at home, who can "tell the produce of a young vineyard, from that of an old one, "after it is brought to England, by the colour of the wine. This "difference is very eaſily accounted for, from the different ſtructure "of the veſſels of the plants: thoſe of the young vines being larger, "and of a looſer texture, eaſily admit a larger quantity of groſs "nouriſhment to paſs through them; whereas thoſe of old vines, "which are more woody, are more cloſely conſtricted, and thereby "the juice is better ſtrained in paſſing through them, which muſt "conſequently render it much better, though the grapes from a "young vineyard will be larger, and afford a greater quantity of "juice: ſo that people ſhould not be diſcouraged if their wines at "firſt are not ſo good as they would wiſh; ſince afterward, when "the vineyard is a few years older, the wine may anſwer their ex-"pectation.

"The vineyard being now arrived to a bearing ſtate, ſhould be "treated after the following manner: firſt, in the pruning there "ſhould never be too many branches left upon a root, nor thoſe too "long: for although by doing of this, there may be a greater quan-"tity of fruit produced, yet the juice of theſe will never be ſo "good as when there is a moderate quantity which will be better "nouriſhed, and the roots of the plants not ſo much weakened; "which is found to be of ſo bad conſequence to vineyards, that "when gentlemen abroad let out vineyards to *vignerons*, there is "always a clauſe inſerted in their leaſes to direct how many ſhoots "ſhall be left upon each vine, and the number of eyes to which "the branches muſt be ſhortened; becauſe were not the *vignerons* "thus tied down, they would overbear the vines; ſo that in a few "years they would exhauſt their roots, and render them ſo weak as "not to be recovered again in ſeveral years; and their wine would "be ſo bad, as to bring a diſreputation on the vineyard, to the great "loſs of the proprietor.

"The

"The number of branches which the Italians generally agree to "leave upon a ſtrong vine, are four; two of the ſtrongeſt have four "eyes, and the two weaker are ſhortened down to two eyes each; "which is very different from the common practice in England, "where it is uſual to ſee ſix or eight branches left upon each root, "and thoſe perhaps with ſix or eight eyes to each; ſo that if "theſe are fruitful, one root muſt produce near four times the num-"ber of bunches which the Italians do ever permit; and conſe-"quently the fruit will not be ſo well nouriſhed, and the roots will "alſo be greatly weakened; as is the caſe of all ſorts of fruit "trees, when a greater quantity of fruit is left on, than the trees "can nouriſh.

"The next thing is, conſtantly to keep the ground perfectly clean "between the vines, never permitting any ſort of plants or weeds "to grow there. The ground ſhould alſo be carefully dug every "ſpring, and every third year have ſome manure, which ſhould be "of different ſorts, according to the nature of the ground, or what "can be moſt conveniently procured.

"If the land is ſtiff, and inclinable to bind on the ſurface, then "ſea ſand, or ſea coal aſhes, are either of them very good manure "for it: but if the ground be looſe and dry, then a little lime mixed "with dung, is the beſt manure. This muſt be ſpread thin "upon the ſurface of the ground before it is dug, and in digging "ſhould be buried equally in every part of the vineyard. Theſe "are much preferable to that of all dung for vines; ſo that it will "be worth the expence to procure either of them: and as they re-"quire manuring but every third year, where the vineyard is large, "it may be divided into three equal parts, each of which may be "manured in its turn, whereby the expence will be but little "every year; whereas when the whole is manured together, it will "add to the expence; and in many places there cannot be a ſuffici-"ent quantity procured to manure a large vineyard in one year.

"This digging and manuring ſhould always be performed about "the beginning of March, at which time all the ſuperficial or day "roots, as they are called, muſt be cut off, but the larger roots muſt "not be injured by the ſpade, *&c.* therefore the ground cloſe to the "ſtem of the vines muſt not be dug very deep. After this is done, "the ſtakes ſhould be placed down, one on each ſide the vines, at "about ſixteen inches from their ſtems, to which the longeſt bearing "branches ſhould be faſtened, and one ſtake cloſe to the ſtem, to

" which the two ſhorter branches ſhould be trained upright, to fur-
" niſh wood for the ſucceding year.

" In the ſummer, they muſt be carefully looked over, as before, " rubbing off all weak dangling ſhoots, and training the good ones " to the ſtakes regularly, as they are produced, and thoſe of them " which have fruit ſhould be ſtopped in June, about three joints be- " yond the bunches; but the upright ſhoots, which are deſigned for " bearing the following year, muſt not be ſtopped till the middle of " July, when they may be left about five feet long: for if they are " ſtopped ſooner in the year, it will cauſe them to ſhoot out many " dangling branches from the ſides of the eyes, which will not only " occaſion more trouble to diſplace them, but will alſo be injurious " to the eyes or buds.

" All this ſummer dreſſing ſhould be performed with the " thumb and finger, and not with knives, becauſe the wounds " made by inſtruments in ſummer do not heal ſo ſoon as when ſtop- " ped by gently nipping the leading bud, which, if done before the " ſhoot is become woody, may be effected with great eaſe, being " very tender while young.

" When a vineyard is thus carefully dreſſed, it will afford as " much pleaſure in viewing it as any plantation of trees and ſhrubs " whatever, the rows being regular: and if the ſtakes are exactly " placed, and the upright ſhoots ſtopped to an equal height, there " is nothing in nature which will make a more beautiful appearance; " and during the ſeaſon that the vines are in flower, they emit a moſt " grateful ſcent, eſpecially in the morning and evening; and when " the grapes begin to ripen, there will be a freſh pleaſure ariſing in " viewing of them.

" But as the beauty of vineyards ariſes from the regular diſpoſi- " tion of the branches of the vines, great care ſhould be taken, in " their management, to train them regularly, and to provide every " year for new wood to bear the ſucceding year: becauſe the wood " which has produced fruit is commonly cut quite away after the " fruit is gathered, or at leaſt is ſhortened down to two eyes, to " force out ſhoots for the next year, where there is not a ſufficient " number of branches upon the vine of thoſe trained upright; ſo that " in ſummer, when the vines are in perfection, there ſhould be ſix " upright ſhoots trained for the next year's wood, and three or four " bearing branches with fruit on them: more than theſe ought ne- " ver to be left upon one vine.

The

" The Auvernat, or true Burgundy grape, is valued in France " before any other ſort, becauſe the fruit never grows very cloſe " upon the bunches, and therefore is more equally ripened; for " which reaſon it ſhould alſo be preferred in England: though in " general, thoſe ſorts are moſt eſteemed with us that have always " cloſe bunches, which is certainly wrong: for it may be obſerved, " that the grapes on ſuch bunches are commonly ripe on one ſide, " and green on the other; which is a bad quality for ſuch as are " preſſed to make wine."

SECT. III.

Extract of a Letter from M. ROUSEL *in* Brie, *to* M. DU HAMEL, *written in the year* 1755.

" I Have begun to try the new huſbandry upon the vine. It is " hard to pay at leaſt 120 livres a year for dreſſing an arpent of " vineyard, to have only our poor wine of Brie; eſpecially when " the vines are entirely frozen, as they were laſt year, or laid bare " to the very wood, by hail, as was the caſe in Auguſt laſt. I am " therefore trying to find out a way to manage vines, without be- " ing at the expence of dreſſing, or propping them, and by which " they may be leſs expoſed to the injuries of the weather, and leſs " liable to be plundered by thieves. To this end, I pitched upon a " ſpot of ground, about half an arpent in extent, which had for- " merly been a vineyard, but was grubbed up many years ago. I plant- " ed on it 400 poplars, ſix feet aſunder, in a quincunx form. As the " roots of this tree are few and ſmall, I thought that diſtance might " be ſufficient. At the foot of each of theſe trees, I planted two " vine cuttings, one on each ſide. The alleys are plowed, in order " to their being ſown alternately, with corn or pulſe, ſuch as len- " tils, beans, barley, oats, *&c.* the produce of which pays the " expence of plowing: whilſt the three feet on one ſide of the tree " are ſown, the three feet on the other ſide are plowed at proper " times and ſeaſons; by which means, both ſides of the tree, and " conſequently both the vines, receive in turns the benefit of the " ſtirring of the ground. All my plants have taken well. I intend " to let the vines run up the trees, without doing any thing to " them; and ſhall wait with patience the event of their produce, " which, be it more or leſs, will be ſo much clear gain, as it will " have coſt me nothing. This method was immediately approved

" of by the country people hereabouts, ſeveral of whom are now " following my example. What helped to give them this good opi- " nion of it, ſo ſuddenly, was, the example of a vine, which " chances to grow a league from hence, in the middle of a field, at " the foot of a pear tree, and which never is either pruned or cul- " tivated. Laſt year, when all the vines of this country were ſo " damaged by the froſt, as not to produce any fruit at all; this vine " eſcaped unhurt, and bore as many grapes as yielded a barrel of " wine. If the future produce of my vineyard, which contains " 800 vines, were to be eſtimated on this footing, it would amount " to 800 barrels of wine every year. But as no one can be ſo ab- " ſurd as to make any ſuch calculation, ſo, on the other hand, I " believe none will deny but that my vines, producing only the two " hundreth part of that proportion, will yield me four barrels of " wine, which will not have coſt me any thing. And even ſup- " poſing them not to yield me any thing, ſtill I ſhall loſe nothing, " becauſe they will have coſt me nothing. The 400 poplars, which do " not ſtand me in above a penny apiece, (being planted only by ſlips, " without making or digging either holes or trenches for them,) can- " not fail, in a ſoil that is quite fit for them, to be worth, twenty- " five years hence, 10 livres apiece, or 4000 livres the whole; " which will be an excellent payment for the ground they will have " taken up. I do not, however, mean to extend this method to " all my vineyards. In moſt of them, the ſoil, though fit for the " vine, is too dry and ſtoney for the poplar. In Italy, vines are fre- " quently planted at the foot of mulberry and other trees. The " only thing neceſſary in that caſe, is, to make the alleys of a width " proportioned to the ſhade of the trees.

" I have begun to cultivate vines with the horſe-hoe, and ſhall not " fail to inform the public of my ſucceſs in that method."

SECT. IV.

Experiment on the Vine, cultivated according to the principles of the New Huſbandry, with remarks thereupon, by M. de Chateau-vieux.

WHEN I began to reflect attentively on the principles of the new huſbandry, I ſoon perceived that it might prove a means of perfecting the culture of our vineyards, as well as that of our other lands.

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I was the more readily induced to turn my thoughts towards that important branch of agriculture, as it ſeemed to me to have been too much neglected for a long time. I plainly ſaw, that our methods of cultivating the vine were, in general, not only defective, but badly executed, and that, in the common way of planting vineyards, the produce could not be proportioned to the great expence.

I ſhall not at preſent enter into a detail of the principles and motives of my new ſcheme for the culture of the vine: that taſk would be too long for this work: and I ſhould likewiſe be glad firſt to ſee the advantages of my method confirmed by a ſeries of experiments repeated for ſeveral years together. My different operations, and firſt ſucceſs, are all that I ſhall mention now.

Every country has, in the culture of the vine, ſome practice or other peculiar to itſelf, and which is thought eſſential there, though it be rejected in other places. All agree in pruning the vine, and in ſtirring the earth round it: but neither of theſe operations is performed in the ſame manner every where.

For the better underſtanding of my new culture, it is neceſſary that I ſhould give an idea of the manner in which our vineyards are laid out and planted. Their expoſition is generally to the Eaſt or South, on a good deep ſoil, which has a gentle declivity, or on the ſide of a hill. The whole ſurface of the ground is planted without order or ſymetry; ſo that the vines are, almoſt always, either too cloſe together, or too far aſunder: very few are at proper diſtances. As the old vines decay and periſh, the chaſms are filled up by layers from the next neighbouring vines. This is the general diſpoſition of our vineyards, from which great inconveniences muſt neceſſarily ariſe: but I ſhall not enter into a detail of them.

With regard to the culture of the vine, it is ſufficient, for my preſent purpoſe, to obſerve, that the whole of that labour is now performed by hand, which renders it very expenſive. I ſay nothing of the manner in which it is executed; that part having appeared to me ſo very defective, that I have been obliged to alter and correct it in every point.

By this ſhort preamble, it may eaſily be ſeen, that in order to improve the culture of the vine, and bring it to greater perfection, it was neceſſary that I ſhould attend chiefly to the three following things. 1. To diſpoſe the vines in a better manner, by planting them in ſtrait lines, and at equal diſtances from each other. 2. To

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contrive that diſpoſition, ſo as to leſſen the preſent expence of culture, by uſing a plough to ſtir the ground in one part of the vineyard, whilſt the other ſhould continue to be ſtirred with the ſpade. 3. To execute the ſeveral cultures of the vine, in ſuch manner as to make them promote its vegetation more than they do in any of the common methods.

I ſhall treat each of theſe three articles ſeparately.

I. *Of the diſpoſition of the Vines in the vineyard.*

THE diſpoſition which ſeemed to me the moſt agreable to the principles of the new huſbandry, by which I was guided, was to lay the vineyard out in beds, as we do fields for corn, obſerving to leave an alley between every two beds, and making each bed five feet wide, in order to plant it with three rows of vines, which, by that means, would be 30 inches aſunder, and the vines at the ſame diſtance from each other in the rows.

As to the alleys, I thought it would be right to make them alſo five feet wide: and what I ſhall ſay hereafter will ſhew, that about that width is neceſſary.

However, as that diſpoſition might not be the beſt, I tried others on ſmall ſpots of ground, by planting the vines at other diſtances. Some were planted in ſingle rows three feet and a half aſunder; others in double rows, and in beds, with alleys of three feet and a half between them. Theſe plantations were made in the ſpring of 1753.

But as I could not expect to ſee the event of theſe trials, till a conſiderable time after making them, eight or ten years, at leaſt, being requiſite to ſhew what the ſucceſs would be, when the vines ſhould be come to their full ſtrength and bearing; I conſidered at the ſame time, by what means I might abridge an experiment which was to be of ſo long a duration.

To that end, I formed a bed of vines, in a vineyard planted 24 years before. The vineyard was good, and yielded plentiful crops. I made my bed five feet wide, and planted it by laying down ſtocks of the old vines, to make the two outward rows, leaving two feet and a half diſtance from one layer to another. The old vines, which happened to be pretty well ſituated, formed the middle row. The remainder of the bed, which is 40 toiſes long, was planted with layers.

An alley, five feet wide, was made on one ſide of this bed, by plucking up the old vines within that diſtance. Some of theſe which were left, ſerved to form a row of vines, ready againſt the making of a ſecond bed parallel to the firſt. It is plain, that the making of a bed in this manner, requires a width of ten feet, *viz.* five feet for the vines, and five feet for the alley. I muſt obſerve, that though both theſe widths are equal, it does not follow that half the vines upon the whole ſurface of the ground is to be retrenched: for one row may ſtill be raiſed in the middle of the alley: conſequently, the number of vines in reality retrenched, is only one fourth. This bed was made, in this manner, in November 1752.

After I had ſeen the crop which it produced in 1754, I no longer heſitated to extend this experiment: and accordingly, in November, I made three other beds, like the former, and cloſe to it.

I not only made no doubt but that the vines, being ſo diſpoſed, and having an equal quantity of earth to draw their nouriſhment from, would thrive better than they do in our common method of cultivating them; but I likewiſe hoped that their being expoſed on all ſides to the influences of the ſun and air, by means of the alleys, would facilitate their vegetation, and haſten the ripening of the grapes.

II. *Of the importance of leſſening the expence of culture, by the new diſpoſition of the vines.*

THIS article will be of no great conſequence to thoſe who are already uſed to cultivate their vineyards with the horſe-hoe: I write it for thoſe only who are not acquainted with that practice.

The manner in which I propoſe diſtributing the vines, ſhews at once the poſſibility and facility of giving the alleys every neceſſary culture, with the ſame ploughs and the ſame cultivator that we uſe for the alleys of our corn fields. I have not found the leaſt difficulty in the execution of this practice.

The ground thus cultivated in the alleys, will be about a third part of the whole: the remaining two thirds will continue to be cultivated by hand, as uſual; and the expence will be conſiderably diminiſhed, by the diſpatch with which the ploughs, or cultivators, will perform their part.

The plough may be brought as near the vines as one pleaſes, provided care be taken not to damage them. An expert huſbandman will eaſily know how to manage in that reſpect.

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Another diminution of the expence attending the common culture of vineyards is, that as, by the method which I propose, the number of vines will be fewer, they will of course require less labour, and therefore less cost; and the vine-dressers, meeting with no hinderances or obstructions between the vines planted regularly in rows, will do more work in a day, and that much better, than in the old way. There will also be less occasion for many things necessary to the vine, such as propping, tying-up, dunging, *&c.* Consequently this new culture will prove a considerable saving.

It is well known how much vines are hurt when too great a quantity of water is retained in the ground. It chills them too much; their juices become less exalted, numbers of weeds spring up, *&c.* These inconveniencies will be remedied in a great measure, by means of the alleys, by cutting with the plough, as I have done, towards the beginning of winter, a furrow along the sides of the bed. The water will drain off into that furrow, and the bed will retain only the degree of moisture necessary for the vines.

III. *Of the means of rendering the culture of the vine more beneficial to the plant and its fruit.*

I Shall speak only of the two principal parts of the culture of the vine, *viz.* the pruning of it, and the stirring of the ground; and at what time each of these ought to be performed.

Before I began to execute the alterations I had thoughts of making in this culture, I had endeavoured to make myself so far master of it, as to be in less danger of miscarrying in my experiment.

The custom of this country is, to prune the vine during and after winter; frequently beginning that work about the end of January. I always thought that a wrong season; and judged that it would be much better to prune the vine before winter, immediately after the vintage is ended. Experience has since shewed me that I was right.

In November 1750, I pruned above fifty vines with my own hands: none of them suffered in the least by the winter's frosts: they made strong and vigorous shoots, and produced a greater quantity of grapes than any of the neighbouring vines.

The next year, and in the same month, I pruned the same vines again. This pruning had the same success as the year before. Encouraged by this repeated experience, I determined to make the bed I mentioned before, in my old vineyard. The vines have continued to be pruned before winter, always with ſucceſs, and without any ſort of inconvenience.

Satisfied with theſe firſt trials, I thought I might ſafely venture to extend the ſame practice to larger tracts of ground. I had about two arpents of vines, which had produced very little wood for two years paſt. The branches were ſo poor and ſlender, that they would ſcarce bear laying down: in ſhort, the vineyard periſhed daily. I conceived hopes of recovering it by means of this pruning. Accordingly, I pruned it in November 1754; and in 1755, the vines produced ſtronger and longer ſhoots. As the branches would then bear laying down, I began to repleniſh part of the vacant places. By this means, my vineyard was replanted with young vines, and quite renewed, only by altering the time of pruning.

This laſt pruning underwent a ſevere trial, from the exceſſive hard froſts of the winter of 1755: yet, intenſe as the cold was, my plants bore it, without being hurt at all. I then looked upon it as certain, that the vine might be pruned before winter, without any danger from the inclemency of that ſeaſon.

It was abſolutely neceſſary that the vine ſhould bear pruning at that time, in order to enable me to perform the other cultures in their proper and moſt favourable ſeaſons.

That the vine may be benefited as much as poſſible by every ſtirring of the earth about its roots, thoſe ſtirrings ought certainly to be performed at the times when they may be moſt likely to excite the greateſt vegetation. Let us ſee whether the common practice anſwers that end. The uſual time of beginning to dreſs the vineyard, is in the ſpring, immediately after pruning the vines. Three dreſſings are judged ſufficient, and it is generally thought that the laſt ſhould be finiſhed by midſummer. The plants are then left to ſhift for themſelves, till the time of vintage, which is upwards of three months after. During that time, quantities of weeds generally ſhoot up, which ſhade the vines, and hinder the grapes from ripening as they ought. Careful huſbandmen pull them up: but the greater part are unwilling to take that trouble.

In the common way of cultivating the vine, the earth is firſt ſtirred when the buds are juſt ready to come out, and even after they are come out: a time always extremely critical, becauſe the uncertainty of the ſeaſon expoſes the buds to ſeveral dangers, which are increaſed by that ſtirring of the earth, from whence many exhalations, oftentimes very pernicious, proceed at this ſeaſon. Would it not be much better to let the vineyard reſt while the vine is budding?

The laſt ſtirring, which is given about midſummer, is too long before the vintage, and therefore is almoſt always followed by great quantities of weeds. Might not this laſt culture be performed later?

I have experienced that theſe inconveniencies may be avoided, without falling into others. To this end, after the vine has been pruned, before winter, let the earth be firſt ſtirred in that ſeaſon: the ſecond ſtirring, which would otherwiſe be immediately after winter, may then be deferred till towards the end of May: and the third ſtirring may be given in the beginning of Auguſt, or about the end of July.

This has been my method of cultivating my vines, ever ſince their being planted in beds. The beds are dug by hand, and the alleys are ſtirred with the plough or the cultivator.

The firſt ſtirring before winter, produces the ſame effect on the vineyards, as it does on our beds of corn. The water is drained off, and the winter's froſts penetrate the earth, divide it, and keep it looſe and light.

It remains in this ſtate till towards the end of May, when it receives the firſt ſtirring after winter: and, to have a more certain rule to go by, the ſecond ſtirring ſhould not be given till after the props have been ſtuck, the vines have budded, and the ſhoots have been tied up to the props. This ſtirring may be given, either a little ſooner, or a little later, than is mentioned above, according to the ſeaſon. Sometimes one may be obliged to haſten it, if the ground is greatly burdened with weeds: but at whatever time it be performed near the end of May, it is certain that the vine will then have made great ſhoots, and that without having been diſturbed by any ſtirring of the earth during the time of its tender vegetation. As I have tried this culture in hot and very dry years, I have ſeen that the earth has not grown hard, but has retained the neceſſary degree of moiſture, ſo as to be ſtirred with the greateſt eaſe.

The third ſtirring, which is the ſecond after winter, being deferred till towards the end of Auguſt, or at leaſt till the end of July, weeds have not time to grow in any quantity between that and the ſeaſon of the vintage: and what will render it ſtill more beneficial, is, is, that this is the time when the grapes fill moſt, and are drawing towards a ſtate of maturity.

I may perhaps be thought not to enlarge enough on ſo important a ſubject as this. It will, I confeſs, require being treated more fully hereafter: but in the mean time I beg the reader to conſider, that I am now relating only the ſucceſs of my firſt trials.

SECT. V.

Good effects of this culture proved by the produce of a bed of vines forty toiſes long, planted in 1752.

I Obſerved, in the beginning of this article, that every culture of the vine is performed with much greater eaſe and expedition in vineyards laid out in beds, than in thoſe which are planted all over, but at random. The very ſituation of the vines planted regularly in beds, is ſufficient to ſhew with what eaſe every thing that they require may be done, and that they muſt, of courſe, be well cultivated in every reſpect.

In the next place, the pruning of the vine, and the firſt ſtirring of the earth before winter, are done at a time when the buſineſs of the field is over, and huſbandmen are, in ſome meaſure, un-occupied. That time, which would otherwiſe be in a manner loſt, may now be employed to very great advantage; and in conſequence of their being advanced in their works, before the coming on of winter, inſtead of being over-loaded in the ſpring, by a multitude of things to be done at that time, they will have ample leiſure to attend properly, and without being hurried, to every branch of culture that a farm requires.

The effect of our culture has been extremely viſible. The new vines have grown ſo prodigiouſly, that they now greatly ſurpaſs thoſe of the old vineyard, which they were part of: the ſhoots too are thicker and longer, and the branches of grapes bigger and in greater number.

When I firſt began to apply the principles of the new huſbandry to the culture of the vine, I hoped indeed that the great fruitfulneſs of a ſmaller number of plants, might compenſate for the loſs of thoſe I was obliged to retrench: but I was agreably ſurpriſed to find all the vines of my bed loaded with an equal quantity of grapes.

'Tho' my conjecture was founded on principles which I knew to be true, I was still farther confirmed in my opinion by an observation I had made, that, even in our best vineyards, there are always great numbers of vines which absolutely bear no fruit at all, and many others which produce but very little; so that it is not on the great number of plants that the great produce of the vineyard depends, but on the goodness of those plants.

Accordingly, I concluded that I ought not to look upon my having taken up some vines in order to form the alley, as a loss, provided those in the bed were enabled by good culture to yield their utmost productions. The event shewed that I was right.

I likewise judged that the grapes would ripen more perfectly in this new way, than in the old: and in that too I was not mistaken; for they were much higher flavoured, and made far better wine.

Besides these advantages, this culture preserved my vines from a very bad accident, which happens frequently, especially when the autumn is rainy: I mean, the rotting of the grapes. In our common vineyards, the grapes ripen, smothered beneath that quantity of leaves with which the vines are loaded, and surrounded by numbers of weeds, which often grow higher than the vines themselves. Add to this, that the air around them is filled with various exhalations from the earth, which, for want of a free circulation, remain suspended about the plants. These causes cannot but make the grapes rot, and the wine that is made of them, must be greatly inferior to what it would otherwise be.

Our vines in beds, being much less, if at all, liable to any of these accidents, will have the advantage of preserving their grapes sound and without rottenness, till they are perfectly ripe. This I have already experienced, at a time when above half the grapes of my old vineyard were absolutely rotten.

Notwithstanding all the advantages of this new method, which, I may say, I have only glanced at; they would probably not be regarded, if they were not attended with greater fruitfulness than is obtained in the common way. I shall therefore shew, that the produce of my young vines was very considerable, and greatly superior to that of my old vineyard.

My bed, as I observed before, was formed in November 1752; and the two outward rows consisted, in a great measure, of young layers,

layers, which not being old enough in 1753, to bear much fruit, I could not expect any great matter from them that year. However, they bore as much as could reaſonably be deſired. A violent ſtorm of hail which fell in June, left ſcarce any thing to be gathered in all our other vineyards.

The year 1754, produced, in general, but little wine. The young plants of my bed, being only in their ſecond year, were too weak to diſtinguiſh themſelves by any extraordinary quantity of fruit; tho' their vigour gave great hopes for future years. However, even in this, they were loaded with ſo many and ſo large bunches of grapes, that they yielded rather more wine than the old vines which were next them.

The year 1755, was one of the beſt years for wine, that has been known for a long time. The quantity was plentiful, and the quality exceeding good. The youngeſt plants of my bed, which were only in their third year, ſeemed no way inferior to the old vines cultivated in the common way.

This bed, 40 toiſes long, and 10 feet wide, including the alleys, contained 66 ſquare toiſes and 24 ſquare feet. It yielded three hundred and thirty-ſix pints of wine, Paris meaſure, which was after the rate of two-fifths more than I had from my old vineyard; or to explain myſelf ſtill better, if my whole vineyard had been laid out in beds, it would have yielded five barrels of wine, for every three that it did yield.

Twenty beds of the ſize of that we are ſpeaking of, would make about an arpent; that is to ſay, they would contain 1333 ſquare toiſes, and 12 ſquare feet: and thoſe twenty beds, ſuppoſing them all to produce alike, would, after the rate of this, yield 6720 Paris pints, or 23 hogſheads and 96 pints; which, in this country, is a prodigious quantity, ſuch as no vineyard here has ever yet produced.

The vintage of 1756, was neither plentiful nor good. I therefore did not make any compariſon; but remained ſatisfied with obſerving in general, that my bed produced at leaſt as much as the old vineyard.

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SECT. VI.

General Directions for making Wine.

AFTER the above accounts of the culture of the vine, it may not be improper to give ſome general directions for making wine. As it would be foreign to our purpoſe to enter into a detail of the particular cultures of the vine, as practiſed in different countries, and of their ſeveral methods of making their wine, we refer the curious to what Mr. Miller has ſaid on theſe ſubjects, in the articles *Vitis* and *Wine*.

The grapes muſt be of a proper degree of ripeneſs: becauſe the juice of un-ripe grapes, or other fruit, is a rough acid liquor, which is with great difficulty made to undergo a vinous fermentation. In ſome inſtances, as in verjuice, it will remain in the ſame ſtate for years together: but after the grapes are come to a due maturity, the juice is no ſooner preſſed into a veſſel, than it ferments, and becomes wine.

Some kinds of grapes are naturally of this auſtere acid quality, which prevents their fermenting kindly. It has been found by experience, that this may be corrected by the mixture of ſuch ſubſtances as correct the acid; for inſtance, the fixed alkaline ſalt of plants, in a due proportion, chalk, crabs-eyes, or other abſorbent bodies.

Some gentlemen in England and America, when the juice of their grapes has not fermented kindly, have obtained a very good wine, by expoſing the containing veſſels, in a warm ſituation, to the ſun, with an intention of turning it to vinegar. Chemiſts know that all vegetable acids are volatile in certain degrees of heat. Perhaps the effect of this ſummer expoſure may be the evaporation of the acid, and thereby the converſion of the whole to a mild vinous fluid. There are not inſtances wanting of the rougheſt verjuice being turned to a ſtrong pleaſant cyder, or vinous fluid, by means of a warm ſituation accidentally given it.

When the juice is too watery, the addition of ſugar, raiſins, or whatever can give it a due conſiſtence, will correct this quality; as is frequently experienced in the juice of currants, gooſeberries, &c. It is likewiſe a frequent practice, in making cyder, to ſet the juice of the apples, when it is found too watery, in broad ſhallow veſſels,

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over a fire, where it is kept in a conſiderable degree of heat, (but not ſuffered to boil,) till the ſuperfluous moiſture is evaporated. Might not the ſame method be practiſed to advantage in the making of wine?

The acidity and waterineſs of the juice of the grapes may be likewiſe remedied by a proper culture of the vine. If the heat of the climate is not great enough to ripen the grapes, eſpecially in cold rainy ſeaſons, the warmeſt and drieſt ſituations and ſoils ſhould be choſen for the vines. A free and open expoſure, whereby the ſun may have acceſs to the vines, might perhaps bring the wild vines in America to ripen their fruit, and exalt its juice to a much higher flavour. Mr. Miller, therefore, judiciouſly adviſes the people of America to plant their vines on riſing grounds, where the bottom is rocky or hard near the ſurface.

The grapes in America are liable to burſt; which Mr. Miller imputes, either to the too great moiſture of the air in that country, or to their receiving too much nouriſhment from their over rich ſoil. Gentlemen of America think their air, except in marſhy countries, is dryer than ours, and are therefore of opinion that the burſting of their grapes is not owing to the too great moiſture of the air. If it proceeds from too much nouriſhment, the remedy would ſeem to be eaſy: *viz.* training up a greater number of branches to conſume that nouriſhment. Others, perhaps with more reaſon, impute their burſting to their ripening too early, while the heavy rains, frequent in autumn, fall. In this caſe, they may be trained up againſt lofty trees. The reflection of the heat, from the earth, would then be leſs, and the leaves of the trees would ſhelter the grapes from the ſun. By this means, being later before they fill, they would not be ſo apt to burſt; and as the latter end of the autumn is generally fair, they may then have an opportunity of coming to their full maturity, without the danger of burſting. Or if it is thought more adviſeable to quicken their ripening, the warmeſt ſoil and ſituation ſhould be choſen for the vines, and they ſhould not be permitted to riſe to a great height.

We have ſometimes been inclined to think that the ſummer pruning of the vine, which is inteuded to haſten the ripening and increaſe the goodneſs of the grapes, has the contrary effect.

In the ſpring, and while plants are in a growing ſtate, their juices are of a watery acid nature, abounding in what the chemiſts call their

native

native ſalt. As the ſummer advances, or as, reſpectively in each, their ſeed or fruit begins to ripen, their juices loſe that ſaline watery ſtate, and become gradually milder: and when their ſeed or fruit is come to full maturity, the juices of perennial plants become of an oily mucilaginous quality. This change in the nature of the juice of plants is gradual, and perfect in proportion to the flouriſhing ſtate of the plant. If the vines are pruned while they are yet in a growing ſtate, nature is checked in bringing about this change: for not being able to extend the branches farther in length, the buds for the next year ſwell, and ſhoot out; whereby a new vegetation is brought on, and the juices are kept longer in their ſaline ſtate. Surely, as in animal digeſtion, the more perfect and ſtrong the powers of the animal (or plant) remain, the higher and more perfect muſt its juices become.

When the grapes are too ripe, or the weather continues too warm at the time that the grapes muſt neceſſarily be gathered, their juice is apt to ferment too much and too quickly, whereby the vinous ſpirit is evaporated, and the liquor becomes vapid. To remedy this, in countries liable to much heat, there ſhould be cool places built for carrying on this fermentation. A gentleman, who had no ſuch conveniency, contrived the following method to ſupply the want of it. Near his houſe was a ſpring, the water of which he conveyed by pipes into a cellar of an out-houſe, and when he had a mind to check the fermentation, he raiſed the water in the cellar to what height he found proper, ſo as to cover the whole or part of his veſſels. If the veſſel was entirely immerſed in the water before the liquor had begun to ferment, he found that it continued in the ſame ſtate for months. Thus, having preſſed ſome apples, and having immediately immerſed the containing veſſel in his cellar, he let it remain there till the ſpring, when, on his carrying it into a warmer place, it fermented, and became excellent cyder. Mr. Boyle relates a parallel inſtance, in his *Hiſtory of Cold.*

In ſome countries, they make it a general rule to gather their grapes when dry; and in others they as carefully gather them only when they are wet with dew. In both, the circumſtances of the ſeaſons ſhould, perhaps, vary this cuſtom. Thus, when a warm kindly ſeaſon has brought the grapes to a due maturity, ſuch juice wants no addition: if a dry ſeaſon has perhaps thickened their juice too much, the dew may remedy that defect: and if a cold or rainy ſeaſon has prevented their ripening thoroughly, and they ſtill continue

tinue in an acid watery ſtate, ſurely the warmeſt and dryeſt hours ſhould be choſen for gathering them.

We cannot here help lamenting the want of experiments performed with accuracy and judgment on this ſubject.

When the grapes are to be gathered, a ſufficient number of labourers ſhould go into the vineyard, each provided with a baſket and knife, and cut, as cloſe as poſſible to the fruit, thoſe bunches only which appear ripeſt and moſt open; leaving for a future cutting ſuch as are green, or cloſe: for cloſe bunches never ripen thoroughly. All rotten or burſten grapes, whether occaſioned by over-ripeneſs or any other accident, ſhould alſo be avoided. The bunches thus gathered ſhould be laid gently in the baſkets, without bruiſing or preſſing them. The more expeditiouſly they are gathered, the finer will be the colour of the wine, and the ſooner they are preſſed, the better will its quality be.

For white wine, the grapes ſhould be put immediately in the preſs, which, being let down upon them, will, by its weight alone, force out the liquor plentifully. This firſt running is eſteemed the moſt delicate. When the liquor ceaſes to run, the preſs is raiſed, and the cakes of grapes round its ſides are pared off with an iron ſhovel made purpoſely for that uſe, and thrown up again, together with the looſe ſcattered grapes. The preſs is then let down again on them, and ſcrewed with great force, which occaſions a ſecond running, more plentiful than the firſt, and little inferior to it in flavour or colour, but preferable in this, that it has a ſtronger body, and will keep a conſiderable time longer. This operation is repeated, whilſt any juice remains in the grapes.

To make red wine, after the red grapes are gathered, in doing of which the ſame caution ſhould be obſerved as before, in regard to their ripeneſs, *&c.* the bunches are thrown into large tubs, and there maſhed or bruiſed to pieces, with ſticks, or by putting children into the tubs to tread out their juice. This is repeated, till the veſſel is full: after which the grapes are let lie in their liquor 48 hours, during which time the whole muſt be frequently ſtirred together. This ſtirring raiſes a fermentation, and increaſes the colour of the wine, which becomes of a full bright red. The liquor thus obtained, is then poured off, and is higher flavour'd than that which is afterwards got by preſſing what remains at the bottom of the tubs: tho' this laſt will have the ſtrongeſt body, eſpecially if the preſs is ſcrewed ſo tight as to break the ſeeds of the grapes.

The grapes that were left upon the vines at the time of the firſt cutting, ſhould be gathered as they ripen; and ſo on, to a third and other cuttings, according as it may be found neceſſary.

After the grapes have been preſſed as dry as poſſible, their cakes or huſks ſtill afford a ſpirit, or brandy, by diſtillation.

The new wines will generally ferment of themſelves, within a few days after they have been put into the caſks. Thoſe that do not, ſhould be helped, by putting into them a little of the froth, or yeaſt, that works from the others. The fineſt wines will ferment the ſooneſt: and this fermentation will continue for about ten or twelve days, according to the ſort of the wine, and the ſeaſon of the year.

While the wine ferments, the bung-hole of the caſk muſt be left open, or only covered with a thin cloth, to prevent any dirt from falling in: and this cloth ſhould be laid hollow, ſo that the froth ariſing from the fermentation may have room to work off.

When the fermentation is pretty well over, which is known by the froth's ceaſing to riſe ſo faſt as before, the bung may be cloſed down, after filling up the caſk with liquor within two inches of the top. A vent-hole ſhould then be opened and left, to carry off whatever may be thrown up by any ſubſequent fermentation. This filling up of the caſk to within two inches of the vent-hole, ſhould be regularly obſerved every two days, for about ten or twelve days running: for the fermentation will continue a conſiderable time, though in a leſs degree; and if your caſks are not kept ſo full as that the foulneſs thrown up by the fermentation may be carried off at the vent-hole, it will fall back again into the wine, and render it foul and muddy. After filling up each caſk in this manner, to within two inches of the bung, for about ten or twelve days, it muſt be filled to within an inch every five or ſix days, for the ſpace of a month; after which, once a fortnight will be ſufficient during the next three months.

Tho' the fermentation will be over long before this laſt mentioned time, yet the caſks muſt be filled up once a month, ſo long as they continue in the cellar: for as the wine will waſte inſenſibly in the caſks, it will grow flat and heavy, if they are not kept continually filled up. 'Twere needleſs to ſay that the vent-holes muſt be ſtopt, when the fermentation is over.

In ſeveral parts of Germany, where their grapes, ſeldom coming to full maturity, are gathered ſomewhat green, they have iron ſtoves in their cellars, where they keep a conſtant fire, which, by rarefying and heating the air, ripens and meliorates the wines, and renders them much more palatable and agreable than they would otherwiſe be.

As the wines drawn from the laſt gathering of the grapes cannot be ſo perfect as the others, for want of due maturity in the fruit, the people of Champaign and Burgundy have recourſe to the following method, to accelerate their ripening. When the wines have been about three weeks in the caſks, they roll them up and down therein for ſome time, five or ſix times a day, for four or five days running; then two or three times a day, for three or four days; afterwards, once a day, for about four days; then once a day, for about a week; and after that, once in four or five days. If the grapes were gathered very green, the rolling in this manner is continued, in all, for about five or ſix weeks: but if they were tolerably ripe when gathered, rolling once in four or five days, for about a month or ſix weeks, will be ſufficient. This rolling of the liquor in the caſks will heighten the fermentation, by the agitation of its parts; and the violent motion thereof heats the wine, which cauſes it to purify and purge itſelf, and accelerates its ripening, much better than any other method can do. It likewiſe ſweetens and ſtrengthens it, by mixing and ſhaking it together with its lees, and renders it much more palatable. The ſame method is alſo practiſed when the wine is of too weak a body.

About the middle of December, the wines may be drawn off from the lees into freſh caſks, for the firſt time, taking care to fill the caſks up, and to place them ſo that they may not be ſhaken or diſturbed, until the middle of February, when it will be right to draw them off again into other caſks, which ſhould likewiſe be filled up, and kept where they may not be diſturbed, till the latter end of March, or the beginning of April, at which time it will be proper to ſhift them again into other caſks.

When the wine is fit for bottling, a froſty day, if the ſeaſon of the year will permit, or, for want of that, a cool and dry one ſhould be choſen: experience having ſhewn that wine drawn off either on a hot, or on a cold and moiſt, or a rainy day, will never be ſo fine as that which is bottled in clear ſettled weather. The ſame rule ſhould be obſerved in ſhifting the wine from one caſk to another.

We ſhall cloſe this article with a few directions, which Mr. Miller tells us have occurred to him from ſome obſervations and experiments more particularly relating to the making of wine in England.

The grapes, ſays he, being ripe, ſhould be cut when they are perfectly dry, and carried into a large dry room, where they ſhould be ſpread upon wheat ſtraw, in ſuch manner as not to lie upon each other. In this place they may remain a fortnight, three weeks, or a month, according as there is conveniency; obſerving to let them have air every day, that the moiſture perſpired from the grapes may be carried off. Then, the preſſes and other things being in order, all the grapes ſhould be pulled off the bunches, and put into tubs; taking care to throw away ſuch as are mouldy, rotten, or not ripe, which, if mixed with the others, would ſpoil the wine: the ſtalks of the bunches ſhould alſo be thrown away: becauſe, if they are preſſed with the grapes, an auſtere juice will come from them, which will render the wine ſharp and acid. Mr. Miller is of opinion that the want of this precaution has ſpoiled great quantities of wine made in England, which might otherwiſe have proved very good: for, as he rightly obſerves, in France, and other wine countries, thoſe who pay more regard to the quality than the quantity of their wines, always pick the grapes from off the ſtalks before they are preſſed: much more ought we in England, where the climate is leſs favourable, not to omit any art which may be neceſſary to help the want of ſun.

The grapes, being thus carefully picked, ſhould be well preſſed. If red wine is intended to be made, the huſks and ſtones ſhould be put into the liquor, and if the ſeeds or ſtones of the grapes are broken in the preſs, the wine will be the ſtronger. The liquor and huſks muſt be put into a large vat, where the whole ſhould ferment together five or ſix days: after which the wine ſhould be drawn off, and put into large caſks, leaving the bung-hole open to give vent to the air which is generated by the fermentation. If the wine, after it is preſſed out, and put into the vat with the huſks, does not ferment in a day or two at moſt, it will be proper to add a little warmth to the room, by fires, which will ſoon put it into motion. For want of this, it often happens, where people preſs their wine, and leave it to ferment in open cold places, that the nights, being cool, check the fermentation, and cauſe the wine to be foul, and almoſt ever after upon the fret.

If white wine is deſired, the huſks of the grapes ſhould not remain

main in the liquor above twelve hours, which will be long enough to ſet it a fermenting: and when it is drawn off, and put into other veſſels, it ſhould not remain there above two days before it is drawn off again; and this muſt be repeated three or four times, which will prevent its taking any tincture from the huſks in fermenting.

When the greateſt fermentation is over, the wine ſhould be drawn off into freſh caſks, which ſhould be conſtantly filled up, as before directed, and the bung-hole be left open three weeks or a month, to give vent to the generated air, and room for the ſcum to run over. In filling up the caſks, great care ſhould be taken not to break that ſcum, becauſe it would mix with the wine, make it foul, and give it an ill taſte. The beſt way therefore is, to have for this purpoſe a funnel, with a plate at the ſmall end, bored full of little holes, that the wine may paſs through in ſmall drops, ſo gently as not to break the ſcum.

After the wine has remained in this ſtate a month or ſix weeks, it will be neceſſary to ſtop up the bung-hole, left, by expoſing it too much to the air, the liquor ſhould grow flat, and loſe much of its ſpirit and ſtrength: but it muſt not be ſtopt quite cloſe, but ſhould rather have a pewter or glaſs tube, of about half an inch bore, and two feet long, placed in the middle of the bung-hole. The uſe of this tube is to let the air, which is generated by the fermentation of the wine, paſs off; becauſe, being of a rancid nature, it would ſpoil the wine, if it were pent up in the caſk: and in this tube there may always remain ſome wine, to keep the caſk full, as the wine therein evaporates and ſubſides.

The reverend Dr. Hales has greatly improved this tube, by making it double, *viz.* by having within the outer tube, which he directs to be made two feet long and of about two inches bore, and to be fixed in the bung-hole by a pewter ſocket cloſely cemented, another ſmaller tube, of about half an inch bore. The lower tube ſhould always be kept about half full of wine, which will ſupply the veſſel as the wine therein ſhall ſubſide; and there will be no room left in the upper part of the veſſel, to contain any generated air, which will paſs off through the upper ſmall tube, which muſt always be left open for this purpoſe. As the wine in the lower tube ſubſides, it may be re-filled by introducing a ſlender funnel through the ſmall tube, down to the ſcum upon the ſurface of the wine in the larger tube, ſo as to prevent its being broken by the wine falling too violently

violently upon it. Dr. Hales adds, that if this experiment is tried with glafs tubes, it will give an opportunity to obferve what impreffion the different ftates of the air have upon the wine, by its rifing or falling in the tubes: and if that fucceeds, it may afterwards be done with wooden or metal tubes, which will not be in danger of breaking.

After the wine, and particularly that of countries where the fun is not very powerful, has paffed its fermentation in the vat, and is drawn off into the cafks, it will require fomething to feed upon. To this end, it will be right always to preferve a few bunches of the beft grapes, which may be hung up in a room till there be occafion for them; when they fhould be picked off the ftalks, and two or three good handfuls put into each cafk, according to its fize.

The larger the cafks are, the greater ftrength the wine contained in them will acquire, and confequently it will be the lefs in danger of fuffering from the injuries of the weather.

A PRAC-

A PRACTICAL TREATISE OF HUSBANDRY.

PART IV.

Of the Instruments peculiar to, or useful in, the NEW HUSBANDRY.

CHAP. I.

Of PLOUGHS.

IN our account of the experiments in 1750, we advised, says M. Duhamel, making the first trials of the new husbandry, on small pieces of ground, in order to acquire by degrees a knowledge of many circumstances, which, though they may seem of little consequence, are, in reality, of great importance. If those experiments had been made at once on large tracts of land, any bad success at first setting out, might have discouraged people from making farther trials.

We find with pleaſure, continues our author, that a ſufficient number of experiments has now been made, to create a confidence in this new method of cultivating land, and that proper inſtruments for that purpoſe have been invented. It therefore remains that we give a deſcription of theſe inſtruments, beginning with the ploughs.

Two things are eſſentially neceſſary to all ploughs: the one is, that the ſhare and coulter ſhould enter ſufficiently deep into the unplowed earth, to turn it over into the furrow: the plough is fitted for this purpoſe, by having its ſhare and coulter placed in a direction ſomewhat oblique to the beam, inclining towards the ground that is to be turned over: and the other, which is ſtill more important, is, that the plough be made to pierce to a depth ſuited to the quality of the ſoil. This is eaſily effected with ploughs that have a fore-carriage: and as to thoſe which have none, the plowman may, by the help of their handles, if ſufficiently long, as with a lever, make the ſhare pierce to whatever depth may be thought moſt proper.

M. de Chateau-vieux obſerves, that, in order to plow well, the furrow which is turned over ought not to be cut too wide. The breadth of it ſhould be determined by the quality of the ſoil, according as it is ſtiff or light, dry or moiſt. His furrows are generally between eight and nine inches wide: and as to their depth, he is guided in that reſpect by the nature of the ſoil. Sometimes he has plowed a foot deep; but then the furrows were cut narrow, in order to proportion the reſiſtance of the earth, to the ſtrength of the horſes: for it is as eaſy to them to plow twelve inches deep, with a narrow furrow, as it would be to plow only to the depth of ſix inches, with a wider one.

M. Duhamel took the firſt hint of his plough, from one that he ſaw near Rochefort, the whole fore-carriage of which conſiſted of only one very ſmall wheel, whereby the beam was ſupported at a proper height. While this plough was making, he received M. de Chateau-vieux's deſcription of his: but too late to follow entirely the ideas of that gentleman. However, he was ſtill in time to make ſome alteration in his fore-carriage, by means of which, he thinks his plough has all the advantages of M. de Chateau-vieux's, and that it is even more convenient in ſome reſpects. We, with M. Duhamel, ſhall leave the public to judge which of the two is beſt, after giving a drawing and deſcription of each of them.

SECT.

SECT. I.

Description of M. de Chateau-vieux's *plough.*

Of the Plough head.

THE head of this plough is composed of a wheel 32 inches in diameter, which may be extended to 34 inches, or reduced to 30: but to fall short of, or to exceed those measures, would be attended with inconveniencies. This wheel may be made very light, especially if it be encircled with a thin hoop of iron. It is represented in *Plate* II. *fig.* 1, 2, 3. of which, *fig.* 2, is the plan, and *fig.* 1, the profile.

The frame in which the wheel is placed, is formed by two shafts *A B*, *C D*, *fig.* 2, distant from each other 18 inches, from inside to inside; which fixes the length of the nave of the wheel. These shafts are four feet eight inches long, and may be reduced to four feet four inches, by shortening them at the ends, *C* and *A*. They are about two inches and a quarter square: but the edges should be rounded off. These two pieces are fastened together by the two cross staves *E F*, *G H*, which are two inches and a half wide, and about an inch thick. They are riveted to one of the shafts, at *E* and *G*, where they are not to be loosened at all; and at their other ends *F* and *H*, the shaft must be moveable, so as to be taken off, to let the two cross staves through two mortises in the beam *I K* of the plough; after which the shaft *C D* is put in its place, and fixed with two iron pins, *a*, *b*. Between the two shafts is placed the wheel *L M*, the nave of which is pierced through its center, with a hole proportioned to the thickness of the iron pin or spindle *N O*, which serves for an axle tree, and is represented by the two pricked lines. This spindle, or axle tree, the diameter of which is about three quarters of an inch, ought not to project beyond the outside of the shafts, lest it should lay hold of or hurt the stalks of the corn, when the plough is used. To fix it at *N*, that end is flattened, and bent over the shaft to the middle of its upper side, where it is fastened at *d*, by a small pin driven through it and the shaft.

On the upper surface of each of the shafts, at the ends *A* and *C*, are the hooks *A C*, to which the harness is fastened: and at the other ends *B* and *D*, are two rings, the use of which will be explained hereafter.

The ſhafts *A B*, *C D*, ſhould be pierced with four or five holes, to ſet the wheel more or leſs forward or backward, in order to make the plough ſtrike more or leſs deep into the earth, as may be ſeen in *fig.* 1. *a*, *b*, *c*, *d*. The ſame holes are indicated by the pricked lines on the two ſhafts of *fig.* 2. from *A* to *N*, and from *C* to *O*.

Of the Plough Tail.

THIS part conſiſts of the beam *I K*, *fig.* 1 & 2; the ground-reſt *C D fig.* 1, which is covered by the ſhare *L D*; the handles *K P*, *K Q*, *fig.* 2, and *K P fig.* 1. the ſheat *E F fig.* 1, of which part is pricked in *fig.* 1, and the end appears at *X* in *fig.* 2; the mould board *R S fig.* 2, part of which is ſeen at *N* in *fig.* 1; the coulter *G H fig.* 1, and *T V fig.* 2, and the ſhare *L D fig.* 1, part of which is ſeen at *Y* in *fig.* 2.

The beam is four feet eight inches long, excluſive of the tenon which traverſes the handles. Three inches and a quarter ſquare are very ſufficient in its thickeſt part, which is from *X* to *V*, *fig.* 2. The mortiſes in the beam, which are under *g*, *h*, and through which the two croſs ſtaves *E F*, *G H*, are ſlipt, ſhould be ſo fitted, that the croſs ſtaves may not ſhake or be looſe in them, at the ſame time that the beam ſhould, by their help, ſlip with eaſe over the croſs ſtaves, either to the right towards *E G*, or to the left towards *F H*, according as the intended plowing may require. The beam ſhould be faſtened, either by two nuts, ſcrewed on at *m n*, which will fix it tight to the croſs ſtaves *E F*, *G H*; or by two iron pins, ſtuck through the holes *p* and *q* in the two croſs ſtaves, one to the right in the croſs ſtaff *E F*, and the other to the left in the croſs ſtaff *G H*. Theſe pins will keep the beam ſteady in its place.

The lower part of the ground-reſt ſhould be ſomewhat concave, as is repreſented at *C D*, *fig.* 4, *Pl.* II. in order to leſſen its friction againſt the earth.

The beam *I K*, *fig.* 1, and the ground-reſt *C D*, are faſtened together by the ſheat *F E*, and the handles *P K*, *h*, both of which are riveted to the ground-reſt by two ſtrong iron pins, the heads of which are ſeen at *g* and *h*; and to the beam, as alſo the tenon of the beam which traverſes the handles at *m*, *n*; and by the two wedges, *p*, *o* and *q*, another uſe of which will be explained hereafter.

Wood naturally crooked is beſt to make the handles of, that they may be all of one piece, which ſhould be ſo diſpoſed, that one third of of the ſpace between the two handles, ſhould be on the left ſide, and the two other thirds on the right ſide, in order to facilitate the plowman's walking in the furrow. This diſpoſition is ſhewed in *fig.* 2. in which a line *e, f,* drawn from the middle of the beam, between the two handles, gives to the left ſide a third *Pf,* of the diſtance *P Q* between the two handles, and the two other thirds *f Q* to the other ſide.

For want of wood naturally bent to a proper ſhape, theſe handles may be made of two pieces firmly riveted and faſtened together; and if it ſhould be more convenient to the plowman, the whole ſpace between the handles may be on the right ſide, as in *fig.* 6.

The ſheat *E F fig.* 1, ſhould be very ſtrongly and cloſely faſtened by its tenon to the ground-reſt, at *g*. An intelligent workman will eaſily make it of a proper ſize, which is about two inches and a half wide, and a full inch thick. The inclining of this piece with the ground wriſt, gives it greater ſtrength to reſiſt, than if it was faſtened to it at right angles.

The mould-board, repreſented by *R S, fig.* 2, and *A B, fig.* 7, is from 30 to 31 inches long, and ten inches high or deep. It ought to be placed as in *fig.* 8, where its end *A* forms an acute angle, terminating at the junction of the fin of the ſhare: its other end *B* extends beyond the length of the ground-reſt, againſt which it ought to incline, in ſuch manner that, ſuppoſing the ground-reſt to be lengthened out as far as *C,* the line *C B* would be twelve or thirteen inches long, reckoning from the fartheſt lateral ſurface of the ground-reſt to the fartheſt lateral ſurface of the mould-board, which, being thus placed, will form the width of the furrow.

The lower part of this mould-board is ſloped a little inwards, as is expreſſed by the ſhade in *fig.* 7: and the part *b fig.* 7, ſhould jet out at leaſt two inches beyond the part *a*. To this end, the mould-board ſhould be made of a plank about three inches thick, which will bear ſcooping on both ſides, in order to give it the concavity without, and the convexity within, repreſented in *fig.* 3 and 7.

The mould-board ſhould be well faſtened, to prevent its being diſplaced by the reſiſtance of the earth. The upright piece *C D fig.* 7, which joins to the handles at its end *D,* and to the mould-board at its other end *C,* ſupports it ſtrongly. It is highly neceſſary to cover the part of the mould-board which bears upon the earth, with a thin hoop of iron, in order to preſerve it; for otherwiſe it would ſoon be worn out.

The coulter *GH*, *fig.* 1. ſhould be made of good iron well ſteeled. A notch is cut in the beam to receive it, *fig.* 9 and 10; and as the corners of that notch, *C* and *B*, againſt which the coulter bears hardeſt when the plough works, would ſoon be worn away if the wood was left bare, it is proper to ſecure them with two ſmall pieces of iron *AB*, *CD*, about the ſixth part of an inch in thickneſs, ſcrewed on with flat-headed ſcrews. Theſe pieces of iron will keep the coulter ſteady in its place.

The coulter ſhould be pierced with ſeveral holes, from *E* to *F*, *fig.* 10, to take it higher up, or let it lower down, as occaſion may require. It is faſtened to the beam which is pierced at *E*, *fig.* 9, by a ſtrong iron pin with a ſquare flat head, which is let into the beam and lies even with it, as in *fig.* 10. The other end of this pin, *E*, *fig.* 10, is a ſcrew, fitted with its nut, by which the coulter is faſtened tight to the beam. Upon this ſcrew hangs the handle *A*, *fig.* 1, which ſerves to turn it, and at the end of which is the key which faſtens on the nuts of the iron pins which ſecure the ſhare. By this means, the key to turn the ſcrews is always carried with the plough.

M. de Chateau-vieux's coulters weigh but five or ſix pounds a-piece at moſt, and frequently not more than three pounds.

He places his coulter ſo that its point *G*, *fig.* 1. jets out about an inch beyond the outſide of the ſhare *LC*.

Fig. 12 repreſents the plan of the ſhare, with its dimenſions, as do alſo *fig.* 13 and 14. The point ſhould be made of good ſteel, and the reſt of good iron, neither too ſoft, nor too highly temper'd, that it may not be ſubject to break or bend. The tail of the ſhare, *AB*, *fig.* 12, ſhould be thickeſt from *A* to *C*, becauſe that is the part which bears the greateſt ſtreſs. Its thickneſs diminiſhes gradually to *B*, where the ſhare is faſtened to the ground-reſt. This tail is pierced with two round holes at *A* and *B*, *fig.* 13, through which are put the iron pins *DE*, *FG*, *fig.* 12. which have ſquare flat heads, lying even with the tail of the ſhare. Theſe pins paſs through the ground-reſt, where they are faſtened on the other ſide by the nuts *EG*. A third round hole may be added at *x* *fig.* 13, in order to faſten the ſhare ſtill more firmly to the ground-reſt, with a ſhort flat headed ſcrew.

M. de Chateau-vieux has likewiſe made ſome ploughs with the round holes *a b* *fig.* 13, near *A* and *B*, that the iron pins *DE*, *FG*, *fig.* 12, might not traverſe the tenons of the ſheat and handles; and inſtead

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instead of those iron pins, he has riveted them with wooden pins, and found them keep the whole tighter together than the iron ones.

To the left side of the plough should be fastened the thin board *N*, *fig.* 1 & 7, the use of which is to prevent the earth from tumbling over between the share and the mould-board. Plowing wears the point of the share; but much less than it does that of our common ploughs. However, it must be new pointed from time to time, always observing to make the point incline a little towards the earth, as is represented by the pricked line *D L*, *fig.* 1; that the share may scarcely touch the ground at any other part than *D* and *L*, in order to lessen the friction.

The hind part of the plough, thus formed, is joined to the fore carriage, by running the cross staves *E F*, *G H*, *fig.* 2. through the mortises of the beam, *g* and *h*; and fixed there, either by the screws *m n*, or the pins *p*, *q*. The traces of the first and second horse are fastened to the hooks *A C*; and if a third horse is used, the traces of that third horse are fastened to those of the second. Horses will do better for this plough, than oxen, unless these last have been used to be harnessed one before the other.

The plough thus equipped, may easily be carried to the field, if its hind part is laid upon the little carriage *Æ W*, *fig.* 2. consisting of an iron axle tree *Æ W*, two small wheels *k i*, *l r*, and the two pieces *B t*, *D v*; at the end of which are the hooks *B* and *D*. These wheels are about 21 inches or two feet diameter, and three feet six inches, or even four feet asunder. They are very light, having but a small weight to bear. The hooks of these two pieces *B t*, *D v*, are hooked to the rings *B* and *D* at the end of the shafts; and by this means the plough will be carried upon three wheels, of which *fig.* 1 and 2 shew sufficiently the arrangement and use. *Fig.* 5, shews the slope that should be given to the upper surface of the middle of the axle tree of this small carriage on which the rest of the plough is to be loaded in order to remove it from one place to another, that the ground-rest and other pieces may lie flat and steady upon it.

M. de Chateau-vieux's *directions for using this plough.*

TO open the first furrow, the wheel must be placed at the last hole, towards the extremity of the shafts. This makes the share incline the more, and consequently cut the deeper. But as it would be somewhat troublesome to change the position of the wheel, at every firſt cut of the plough, a very little attention will remedy that inconvenience. It is only inclining the handles of the plough to the right or the left, inſtead of holding them even. The whole plough will incline with the handles, and the ſhare will then enter into the ground with eaſe, and open the firſt furrow. The other furrows are plowed without any ſort of difficulty; and for them, the plough is to be held even, or inclined but very little, either to the right hand or the left, as the ſituation of the land may require.

I generally reſt the beam on the left hand ſide of the fore-carriage: It is eaſy to place it ſo as to leave whatever diſtance is thought proper between the outmoſt row of corn and the furrow that is actually plowing.

The forwarder the wheel is ſet, the deeper the plough cuts: and ſo on the contrary. But if one would have it cut ſtill deeper, or ſhallower, than it can be made to do by altering the poſition of the wheel, that too may eaſily be effected. By looſening a little the wedge above the beam, *p, o, fig.* 1. and driving farther in the wedge *q*, the plough will cut leſs deep: as, on the other hand, the ſhare will be more inclined, and therefore cut deeper, if the wedge *q* under the beam is looſened, and the wedge *p, o,* over it is driven in tighter.

SECT. II.

Deſcription of M. Duhamel's *plough, uſed in the experiments at* Denainvilliers.

THE chief differences between M. de Chateau-vieux's plough, and that of M. Duhamel, are as follow.

1. The beam of this laſt, *A C B*, *Plate* III. is bent from *C* to *B*; whereas that of M. de Chateau-vieux's is nearly ſtrait all along.

2. In conſequence of this curve, the hindmoſt extremity of M. Duhamel's beam, is joined at *B* to the hindermoſt part of the ground-reſt *E*, after paſſing through a mortiſe *F*, in the lower part of the handles: ſo that this beam is joined to the ground-reſt by its extremity *B*, the bottom of the handles *F*, and the ſheat *G*; whilſt that of M. de Chateau-vieux's plough, is joined to the ground-reſt by this ſheat, another which this plough has not, and the lower part of the handles: for the beam does not anſwer to the ground-reſt.

3. The mould board *H I* of this plough, is lighter than that of M. de Chateau-vieux's, and differently ſhaped. In that reſpect, the general cuſtom of the country one lives in, may, and even ſhould be complied with.

4. The

4. The two handles *K K*, are at equal diſtances from the beam, and are joined together by a croſs ſtaff *M*.

5. The ſhare *N*, is pretty much like that of M. de Chateau-vieux's plough, but ſhorter and narrower; ſo that it cuts leſs wide furrows, which M. Duhamel thinks the beſt way of plowing.

6. The coulter *O* of this plough paſſes through a mortiſe in the beam, which is ſtrengthened in this place by hoops of iron, to prevent the beam's being ſplit by the driving in of the wedges *P P* which fix the coulter.

M. Duhamel thinks this hind part of his plough preferable to that of M. de Chateau-vieux's, for light lands: but it would not do ſo well in ſtiff ſoils, becauſe the earth would be apt to clog about the ſheat at *Q*; whereas it is thrown off by M. de Chateau-vieux's plough. M. Duhamel likewiſe approves of making the beam ſtrait, as M. de Chateau-vieux's is, inſtead of giving it the bending from *C* to *B*, eſpecially for ſtiff lands.

7. The beam *C A*, is fixed to the croſs ſtaves *R R* of the fore-carriage of this plough, by the ſcrews and nuts *S S*.

8. The ſhafts *T T*, are faſtened before by a croſs ſtaff *V*, which gives great ſolidity to the fore-carriage, and may be added to M. de Chateau-vieux's plough; not only becauſe the wheel is too large, but likewiſe becauſe it muſt be ſet forwarder or backwarder, in order to make the ſhare cut more or leſs deep.

The wheel of this plough is not ſo large as that of M. de Chateau-vieux's, becauſe the pole, inſtead of being inſerted in the ſhafts *T T*, is let into the ſide pieces *X*, which are faſtened to the ſhafts by the ſcrews and nuts *Y Y*.

The advantages of having the wheel ſmaller, are, 1. That the plough is leſs apt to lean too much on its ſide, and is more eaſily held upright; 2. That the croſs ſtaff *V* may be added to the fore-carriage, by which it is rendered more ſolid; and 3. That the fore-carriage may be made ſhorter than it otherwiſe could be.

The bare inſpection of the draught of this plough, ſhews that it is made to cut more or leſs deep, by ſcrewing the nuts *Y* more or leſs tight, and putting a thicker or thinner wedge between the ſide piece *X* and the ſhaft; which is an eaſier and quicker way, than changing the ſituation of the wheel. But a readier method ſtill, is, to have under the ſhafts *T T*, a falſe ſhaft *Z Z*, fixed with hinges at *&*: for then, by only ſticking the peg *a*, into one of the holes *b*, the

beam

beam is raised or lower'd, in a moment, to whatever degree is thought proper, without altering the position of the wheel.

It is likewise evident, that in order to give the share a greater or less degree of entrance into the earth, nothing more is requisite than to place the beam nearer to, or farther from, the right hand shaft: for the horses, which are harnessed one before another, go, as does also the wheel, in the last made furrow, and the plowman goes in the furrow actually making.

d d. Hooks to fasten on the harness of the horses.
e e. Cramps to fasten the fore-carriage.
f f. Pins to fix the beam to the sheat.
g g. Pegs to fasten the cross staves.
h. A strong pin which goes through the hole *i*, to keep the mould board steady.

CHAP. II.
Of Drill-Ploughs.

SECT. I.
Of Mr. Worlidge's *Drill-Plough.*

THE two first inventions of this kind were Mr. Wolidge's drill-plough, and Don Joseph de Lucatello's Sembrador; both of which may claim the merit of being originals. As neither M. Tull, nor M. Duhamel, have taken any notice of this instrument of Mr. Worlidge, which we are persuaded will fully answer all the ends he proposes, we think it a justice due to one of the best writers on agriculture, to give his own account of it.

"Besides the usual manner of sowing corn, there are," says he, "several other ways of dispersing it, as by setting, and hoeing of it in, *&c.* This art of setting corn seems to be very ancient, as appears by Virgil, *Unguibus infodiunt & ipsis fruges*——and hath been "a long time attempted to be brought into practice again, as appears "by Mr. Platt's *Adam's Tool Revived.*" Mr. Worlidge then points out the defects in Mr. Platt's instruments, and proceeds thus.

"But to remedy and remove all manner of errors and inconveniencies that can be found in setting of corn, I shall here give you "a plain and perfect description of an easy and feasible instrument "that

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" that ſhall diſperſe your corn, grain, or pulſe, of what kind ſoever, " and what diſtance, and in what proportion you pleaſe to deſign, " and that with very great expedition, and very little extraordinary " charge, expence, or hazard.

" Firſt, make a frame of timber, of about two or three inches " ſquare, the breadth of the frame about two foot, the height about " eighteen inches, the length about four foot, more or leſs as you " pleaſe, as at *u u u u*, *fig.* 1. *Plate* IV. Place this frame on two " pair of ordinary wheels, like plough-wheels. The axle-tree of the " two foremoſt wheels is to lock on either ſide, as doth the fore " axle-tree of a waggon, for reaſons hereafter ſhewn. The hinder-" moſt axle-tree, being of iron, and ſquare in the middle, muſt be " fixed to the center of the wheels, that the axis and wheels may " move together: then, about the middle of the frame, in the bot-" tom, let there be fixed an iron inſtrument, or of wood pointed " with iron, like unto a coulter, made a little ſpreading at the bot-" tom, in the nature of a ſhare, made to paſs through two mortiſes " on the top, for its greater ſtrength; and made alſo to be wedged " higher or lower, according as you will have your furrow in depth, " as at *o o*; the uſe whereof is only to make the furrow: ſo that you " muſt make the point thereof of breadth only to move the earth, " and caſt it, or force it, on either ſide, that the corn may fall to " the bottom of the furrow. Then, over this ſhare, or coulter, a " little behind it, may a wooden pipe be made, to come from the " top of the frame to the lower end of the ſhare, tapering down-" ward, as at *p*, and as near as you can to the ſhare: to deliver the " corn immediately, as the ground is opened, and before any earth " falls in; that what earth does afterwards fall in, may fall on the " corn. This pipe is to proceed out of a large hopper fixed on the " top of the frame, that may contain about a buſhel, as at *q*: but " ſo that the corn may gradually deſcend, according to the quantity " you intend to beſtow on an acre. At the very neck of the hopper, " underneath, in the ſquare hollow thereof, muſt be fitted in the " edge of a wheel of wood, about half an inch thick, and propor-" tioned to the cavity of the neck, as behind the letter *r*. The wheel " need not be above two or three inches diameter, and fixed on an " axis extending from one ſide of the frame, to the other: on which " axis is alſo to be another wheel, with an edge on the circumference " thereof, like the wheel of a ſpit or jack, as at *r*, which muſt an-" ſwer to another wheel of the like nature and form, fixed on the

" axis of the hindermoſt of the wheels, as at *s*: then fit a line, (of ſilk is beſt,) becauſe it will not be ſo apt to ſhrink and reach as hemp) " about theſe two wheels, that when the inſtrument moves on the " hindermoſt wheels, by the means of the line, the ſmall wheel, at " the neck of the hopper, may alſo move; which leſſer wheel in the " neck of the hopper, may have ſhort pieces of thick leather fixed in " the circumference thereof, like unto the teeth of a jack-wheel, that " upon its motion it may deduce the corn out of the hopper, in what " proportion you pleaſe: for in caſe it comes too faſt, then you may " by a wedge at the tenon of the piece whereon the hopper reſts, as " at *t*, or at the end of the axis of the leſſer wheel, force the wheel " and hopper together; as in caſe it feeds too ſlow, then may you " remove them by the ſame wedges to a farther diſtance: alſo in caſe " your line be too ſlack or too hard, you may prevent either extream " by a wedge in the place where the axis of the wheel moves, or " by a third wheel, about the middle of the line made to move far- " ther or nearer, as you ſee cauſe.

" Alſo by means of the iron rod *v v*, fixed to the foremoſt axis " that is made to lock, may you guide your engine at pleaſure; " which rod is made crooked at the end of the hopper, leſt that " ſhould injure its motion.

" And at the turning, you may lift up your engine by the handles " at *x*: for whilſt you lift it up, the corn feeds not until you ſet the " ſame down again.

" One horſe and one man may work with this inſtrument, and ſow " land as faſt or faſter than ſix horſes can plough; ſo that you " may with eaſe compute the expence, in caſe your inſtrument be " ſingle: but you may in the ſame frame have two ſhares at twelve " inches diſtance, more or leſs, as you will have the rows of corn " diſtant the one from the other; and two pipes out of the ſame " hopper, and two ſmall wheels on the ſame axis, with other wheels " anſwerable, every whit as eaſy to be performed as one; and then " you may double your proportion of land in a day.

" This inſtrument will always keep the ſame proportion you firſt " ſet it to, which you muſt thus contrive. Firſt, know the length " of the furrow you ſow: then caſt up how many of theſe furrows " at ſuch diſtance your inſtrument is made for (whether a foot, " more or leſs,) will amount to an acre: then conclude how much " to ſow on an acre; as ſuppoſe a buſhel: then divide that buſhel " into ſo many parts as you have furrows or diſtances in that acre:

" then

" then take one or two of thoſe parts, and put into your hopper,
" and obſerve whether it will hold out, or ſuperabound at the end of
" one or two furrows, and accordingly proceed and rectify the
" feeder: or you may judge by your own reaſon, whether it feed
" too faſt or too ſlow.

" In caſe it feeds too faſt, notwithſtanding they be cloſe placed to-
" gether, you may make that wheel at the lower axis, wherein the
" line moves, to be leſs than the upper; then will the motion be
" ſlower: and thus may you make it move as ſlow as you will, by
" augmenting the upper, and diminiſhing the lower wheels wherein
" the line is; and make it move faſter by the contrary rule.

" In caſe you drive apace, it feeds apace: in caſe you drive but
" ſlow, it feeds but ſlowly: here is no error.

" When you come to any turning at the lands end, by lifting up
" the hindermoſt part of the inſtrument, that thoſe whels touch not
" the ground, the feeding of the corn immediately ceaſeth until you
" ſet it down again.

" Alſo all the corn you ſow lies at a certain depth, none too deep,
" nor any too ſhallow.

" You may place a kind of harrow to follow; but the beſt way is
" to have on each ſide each furrow, a piece of wood, a little broad at
" the end, ſet aſlope to force the earth rounding on the corn. This
" may be well placed and fitted to the bottom of this inſtrument,
" juſt behind the ſhare and feeding pipe.

" By this method of ſowing any ſort of grain or pulſe, may be
" ſaved the one half, and in ſome places more, which by the other
" way is either buried ſo deep under clots, that it cannot come up,
" or elſe is ſo ſhallow, that the cold in the winter, or drought in
" the ſummer killeth it, or elſe lies on the ſurface as a prey to the
" fowls of the air: much alſo thereof falls in cluſters, twenty or
" thirty grains where one or two might ſuffice, which are common
" inconveniencies, and uſually happening to the vulgar way of ſow-
" ing corn: the greater half by far is loſt, which in all probability
" may be ſaved by the uſe of this very inſtrument, which will
" doubly requite the extraordinary charge and trouble thereof:
" for here is no corn ſowed under clots, but in rows, as the
" earth is ſtirred and moved: it is all at one certain depth
" and at one certain diſtance, and equally covered, below the
" injury of froſt, and heat, and rapine of birds. Alſo by this
" way corn may be ſown in the very middle or convenient depth of

" the mould, that it may have the ſtrength of the land both below " and above the root: whilſt in the other more uſual way, the corn " falls to the bottom of the furrow on the gravel, clay, or ſuch like " hard ground, where it ſeldom thrives ſo well as what happens to " be in the midſt. This way alſo exceeds the way of *ſetting corn*, " where the pins thruſt into the ground, harden and faſten the " mould, ſo that unleſs the land be very light, it confines the roots " to too narrow a place, which in this way is prevented; as I have " obſerved in garden beans, that thoſe hoed in, proved better " than thoſe ſet with a ſtick.

" By the uſe of this inſtrument alſo may you cover your grain or " pulſe with any rich compoſt you ſhall prepare for that purpoſe, " either with pigeon-dung dry or granulated, or any other ſaline or " lixivial ſubſtance, made diſperſeable, which may drop after the " corn, and prove an excellent improvement: for we find experi- " mentally, that pigeon's dung ſown by the hand on wheat or bar- " ley, mightily advantageth it by the common way of huſbandry: " much more then might we expect this way, where the dung, or ſuch " like ſubſtance is all in the ſame furrow with the corn; whereas in " the other vulgar way, a great part thereof comes not near it.

" It may either be done by having another hopper on the ſame " frame behind that for the corn, wherein the compoſt may be put, " and made to drop ſucceſſively after the corn: or it may be ſown " by another inſtrument to follow the former, which is the better " way, and may both diſperſe the ſoil, and cover both ſoil and " ſeed.

" The corn alſo thus ſown in ranges, you may with much more " conveniency go between, and either weed it or hoe it, and earth it " up as you think good, and at harveſt it will eaſily repay the " charges.

" Alſo the fore-wheels being made to lock to and fro on either " ſide, you may have an upright iron pin fixed to the middle of the " axis, extended to the top of the frame: and from thence a ſmall " rod of iron to come to your hand, with a crooked neck juſt againſt " the neck of the hopper; by means of which iron rod, you may " lock or turn the wheels either way, and guide your inſtrument, " and rectify it, if it deviate out of its right courſe.

" The hopper muſt be broad and ſhallow, that the ſeed preſs not " much harder when it is full, than when it is near empty, leſt it " ſow not proportionably.

" This

"This instrument, although it may at the first seem mysterious "and intricate to the ignorant, yet I am confident it will answer to "every particular of what I have written of it; and any ingenious "wheel-wright, joyner, or carpenter, may easily make the same with "very little instruction, and any ordinary ploughman may use it."

SECT. II.

Of the Sembrador.

IN the account given of this instrument, in the Philosophical Transactions, N°. 60. it is justly observed, that the perfection of agriculture consists in setting the plants at proportionable distances, and giving sufficient depth to the roots, that they may spread to receive that nourishment from the ground, which is necessary to produce and ripen the fruit: but this has been so far from being observed, that all sorts of seeds are sown by handfuls at random; whence it happens, that corn in some places is sowed too thick, in others too thin, and the greater part of it either not covered, or not deep enough: whereby, it is not only exposed to be eaten by birds, but also in cold countries to be spoiled by frost, and in hot climates, by the sun. On these considerations, Don Joseph de Lucatello invented an instrument, which, being fastened to the plough, at once plows, sows, and harrows; whereby the sower's labour is saved, and the grain, falling in order, and in the bottom of the furrow, remains at the same distance under ground, so that in five parts of seed, four are saved, and the increase becomes very considerable.

The following is the description of this instrument.

"*Fig.* 2. *Plate* IV. is a box of wood: *abcd*, the cover of that part into which the corn is put, which is open in *fig.* 3, at *W: efhgkl*, the two sides that cover that part of the box where the cylinder, which is stuck round with three rows of little spoons, is moved about to throw out the grains; which sides are taken off in *fig.* 3, that the cylinder *R S*, and the spoons *x x x* may appear. The internal shape of these sides is expressed in *fig.* 4, where may be seen the four triangular pieces *pppp*, and the triangular interstices *qqq*, which serve to convey the corn, carried up in the spoons, and discharged at the top of the cylinder, to run out of the holes underneath the box.

"*T*, is one of the wheels: *V*, the other end of the cylinder, on which the other wheel is to be fixed.

"This

"This *fembrador*, or box, is, according to Don Lucatello's method, to be tied faft to the hind part of the plough, fo that the corn may fall in the furrow, and at the turning of the plough, its ears may cover the corn of the laft furrow with earth. Care muft be taken that the wheels on the fides of this inftrument do always turn round, and never drag along without turning: to which end, it muft be faftened to the plough-beam, at fuch a height that the nails in the wheels may ftand on the ground, to make them turn round. The ears of the plough ufed on this occafion muft alfo be made larger than ordinary, that they may cover the furrows better, when fown, and make wider furrows to receive the feed."

Both thefe inftruments have their imperfections. The manner in which the wheels, and confequently the cylinder of the fembrador are turned, muft occafion an unequal diftribution of the feed, wherever the ground is rough or ftoney: and in Mr. Worlidge's drill, the feed is liable to be bruifed as it drops from the hopper, by the wheel in the neck of that hopper.

We apprehend that a more ufeful inftrument may be formed out of thefe two, than either of them is as they now ftand: *viz.* by fixing the box of the *fembrador*, in the frame of Mr. Worlidge's drill. A fquare frame, like that, will keep the box more fteady, and therefore render the difcharge of the feed more regular, than it can be either in Don Lucatello's manner, or in a fingle frame, as propofed by M. Diancourt, in an inftrument formed on thefe principles, and of which M. Duhamel gives the following defcription.

On the outfide of the fhafts *a a*, *b b*, (*Plate* IV. *fig.* 5.) are two wheels. Their axle-tree *d d d* turns round with them.

On this axle-tree are two pullies *e e*, which receive into their grove two lines *f f*, which turn the cylinder *G g*, *fig.* 6 and 7. This cylinder has three rows of fpoons fixed in it, and goes through the hollows *z z z z*. (*fig.* 8.) of the half barrel *H h*, *fig.* 7 and 8. This half barrel is placed floping in the box *I*, *I*, *fig.* 7 and 5, as is reprefented at the bottom of that box, at *h*, *fig.* 7.

The box *I* is reprefented with its cover on in *fig.* 5. In *fig.* 7, one of the ends is taken off, to fhew at *b* the end of the half barrel *g*; one of the ends of the cylinder *K*, and fome of the fpoons *l*, *fig.* 6; with an inclined plane *L*, which forms a hopper, into which the feed is put, and from whence it drops to the bottom of the barrel *h*, *fig.* 7, through the pipes *M M M*, *fig.* 9; and *m m m*, *fig.* 7.

These

"This *sembrador*, or box, is, according to Don Lucatello's method, to be tied fast to the hind part of the plough, so that the corn may fall in the furrow, and at the turning of the plough, its ears may cover the corn of the last furrow with earth. Care must be taken that the wheels on the sides of this instrument do always turn round, and never drag along without turning: to which end, it must be fastened to the plough-beam, at such a height that the nails in the wheels may stand on the ground, to make them turn round. The ears of the plough used on this occasion must also be made larger than ordinary, that they may cover the furrows better, when sown, and make wider furrows to receive the seed."

Both these instruments have their imperfections. The manner in which the wheels, and consequently the cylinder of the sembrador are turned, must occasion an unequal distribution of the seed, wherever the ground is rough or stoney: and in Mr. Worlidge's drill, the seed is liable to be bruised as it drops from the hopper, by the wheel in the neck of that hopper.

We apprehend that a more useful instrument may be formed out of these two, than either of them is as they now stand: *viz.* by fixing the box of the *sembrador*, in the frame of Mr. Worlidge's drill. A square frame, like that, will keep the box more steady, and therefore render the discharge of the seed more regular, than it can be either in Don Lucatello's manner, or in a single frame, as proposed by M. Diancourt, in an instrument formed on these principles, and of which M. Duhamel gives the following description.

On the outside of the shafts *a a*, *b b*, (*Plate* IV. *fig.* 5.) are two wheels. Their axle-tree *d d* turns round with them.

On this axle-tree are two pullies *e e*, which receive into their grove two lines *f f*, which turn the cylinder *G g*, *fig.* 6 and 7. This cylinder has three rows of spoons fixed in it, and goes through the hollows *z z z z* (*fig.* 5.) of the half barrel *H b*, *fig.* 7 and 8. This half barrel is placed sloping in the box *I i*, *fig.* 7 and 5, as is represented at the bottom of that box, at *b*, *fig.* 7.

The box *I* is represented with its cover on in *fig.* 5. In *fig.* 7, one of the ends is taken off, to shew at *b* the end of the half barrel *g*; one of the ends of the cylinder *K*, and some of the spoons *k*, with an inclined plane *L*, which forms a hopper, into which the seed is put, and from whence it drops to the bottom of the barrel *b*, through the pipes *M M M*, *fig.* 9, and *m m m*, *fig.* 7.

These

INSERT FOLDOUT HERE

These pipes are bent to the ſhape of the inſide of the half barrel, *fig.* 8, to which they are fixed ſo as not to interrupt the motion of the ſpoons, *fig.* 7; and they extend to the bottom of the barrel, in ſuch manner that, reaching the grain, they give out the ſeed only in proportion to what is taken up by the ſpoons. The direction of theſe pipes is not exactly repreſented in *fig.* 7, becauſe they do not there terminate in the barrel *h*. That part of the drawing is intended only to give an idea of their poſition.

The ſpoons throw the ſeed over at *n*, *fig.* 7, where it falls into the diviſions *o o o*, *fig.* 10, which are faſtened to the ſhafts *a a*, *b b*, *fig.* 5, underneath the box *I*, and drops through the pipes *p p p*, *fig.* 10, which terminate behind the ſhares *q*, *fig.* 11, paſſing through the opening *r*. The ſhares, *fig.* 11, terminate in a triangle at their bottom *s*, forming an angle forward, and a hollow behind. They are faſtened by the ſcrew *t*.

Beſides this, M. Diancourt has placed at *v*, *fig.* 5, a ſmall roller, which is likewiſe repreſented by *V*, *fig.* 12. This roller, which is about ſix inches diameter, is faſtened to the ſtaves *x x*, *fig.* 5, by the two upright irons *y y*, *fig.* 12, by which the roller is placed higher or lower, according as the ſeed is intended to be ſown more or leſs deep: and laſtly, he has fitted to the croſs ſtaff *z*, *fig.* 5, a kind of ſcraper, *fig.* 13, which clears the roller when it is clogged with earth.

Two pullies, one on each ſide, are perhaps preferable to the ſingle wheel which Mr. Worlidge has fixed on his hind axle-tree. The quantity of ſeed to be ſown, may be regulated by the ſize of the pullies, or wheels on the axle-tree: for the larger the pullies are, the more frequently the cylinder on which the ſpoons are fixed, will be turned round, and the ſpoons will conſequently deliver the greater quantity of ſeed. The ſize of the ſpoons may likewiſe be adapted to the ſize of the ſeed intended to be ſown.

SECT. III.

Deſcription of M. Vandusfel's *Rake.*

M. Duhamel, and ſeveral other gentlemen who have practiſed the new huſbandry abroad, met with ſo many difficulties and inconveniences in the uſe of Mr. Tull's drill-plough, that they were obliged to contrive other methods of drilling their corn. One of the ſimpleſt inventions to anſwer this end, was M. Vandusfel's rake, of which

which M. Duhamel gives the following deſcription, which we ſhall copy here for the benefit of ſuch as have not a proper drill-plough; eſpecially as this inſtrument may do very well, where the ſoil is light, and the extent of land intended to be ſown is not large.

It is, as in *Plate* IV. *fig.* 14, a ſtrong kind of rake *c c*, with four great teeth *a a*, *b b*. The diſtance from *a* to *a*, and from *b* to *b*, is nine inches. M. Vandusfel makes it a foot, becauſe, after his corn is ſown, he buries it by drawing a cultivator with two mould boards between the rows.

The diſtance between the two inner teeth *a* and *b*, is three feet and a half; which is the width of the alleys.

To the head of this rake *c c*, are fixed the handles *e*, and the pole *d*, which anſwers to the beam of a plough.

As this inſtrument is drawn over ground in fine tilth, and a man preſſes more or leſs on the handles *e*, it forms four ſmall furrows *f*, *g*, *h*, *i*; ſo that the furrows *i* and *h* are nine inches aſunder, and the furrows *g* and *f* the ſame, and a ſpace of three feet and a half is left between *h* and *g*, for the width of the alley *l l*. In order to preſerve the alleys always of the ſame width, M. Vandusfel draws the teeth *a a* in the furrows before made by the teeth *b b*: ſo that tho' four furrows are made the firſt time this rake is drawn, only two are made each time after.

Great care muſt be taken to make the firſt furrows very ſtrait, becauſe the direction of all the others depends thereon.

Women or children drop the ſeed by hand into theſe furrows, where it is afterwards covered with a harrow, or, as M. Vandusfel has done, with a cultivator with two mould boards, drawn between the two rows, as faſt as they are ſown. If any part chances not to be covered perfectly by this cultivator, it is eaſily done afterwards with a common rake.

SECT. IV.

Deſcription of M. Duhamel's *Drill-Plough.*

M. Duhamel obſerves, that though M. de Chateau-vieux's drill delivers the grain with the greateſt exactneſs, and therefore deſerves much commendation, yet the price of it is too great for moſt farmers. M. Duhamel's, which we are going to deſcribe, has, for that reaſon, been the moſt generally uſed. We could wiſh that the limits preſcribed to this work would permit us to give alſo a full

full deſcription of M. de Chateau-vieux's drill-plough; though we fear it would be too complex to be underſtood or made by common workmen, and, we doubt, too nice in many of its parts for the rough hands of common plowmen. We hope, however, that the ingenious and curious among our countrymen will not, on account of this our omiſſion, be any ways induced not to conſult the original in M. Duhamel's work, or not to endeavour to execute what has been ſo well contrived by one of the greateſt geniuſes in agriculture that this age can boaſt of.

M. Duhamel's drill is fixed to the fore-carriage of a common plough. The make of that fore carriage is ſo well known, that it requires no particular deſcription.

The hind part of this drill conſiſts of a plank *S, S, fig.* 1. *Plate* V. at leaſt three inches thick, which is called the table. Underneath this table, and to the bottom part of it, are ſtrongly fixed, as at *TTT*, three ſhares. The beam, or pole, *I, I,* is faſtened to the fore part of the table: and the handles *L, L,* are let into mortiſes in the back part of the table, in which they are fixed. *a, a, a,* are three cavities cut in the table, to receive the ſeed from the cylinder, and convey it through an opening in the center of each of them, into the hollow *c,* at the back of the ſhare *fig.* 2. The form of theſe cavities is more clearly expreſſed by *a, c, b, fig.* 3. At *b, b, b, b,* are fixed four ſtrong ſtandards, to hold the drill-box ſteady.

The ſhares, *fig.* 2, are made of wood, and terminate at the bottom of their fore part *a,* in a circular form, covered with iron. In their hind part *b* is a groove through which the ſeed drops to the bottom of the furrow. The ſeed is conveyed from the cavities *a, c, b, fig.* 3, to this groove *b, fig.* 4, by means of a thin plate of iron, rounded and fixed to the ſhare, as at *d.* Theſe ſhares are about an inch and a half thick, and their height from *a* to *b* at leaſt a foot.

As theſe ſhares terminate in a curve at bottom, if they meet with any roots, dung not thoroughly rotted, or any other ſubſtance which they cannot eaſily divide, they force it down to the bottom of the furrow, and by that means are never liable to be choaked: and to prevent this ſtill more effectually, the middle ſhare is placed ſomewhat more backward than the two others. It is likewiſe made ſhorter, in proportion to the greater height of the middle of the beds. The ſhares are generally ſeven inches aſunder.

M. Duhamel took the firſt hint of the ſeed box he now uſes, from an invention of Mr. Grenville, then one of the pages of the king of

France's ſtables. This was a hollow ball, fixed upon the axle-tree of two wheels, and pierced round the middle with a row of holes, through which the ſeed dropt as the wheels turned round *.

In the middle of the table *S, S,* are cut three cavities *a, c, b,* ſloping on each ſide down to the center, where a hole of about an inch diameter lets the ſeed drop into the hollow plate *c, fig.* 2. The four ſtandards *i, i, i, i, fig.* 3 and 4, are placed in ſuch manner that the blocks *n, n, fig.* 5, in which a groove is cut, anſwer to the middle of this table. On an iron axle-tree which anſwers to the wheels, and which paſſes through the center of the blocks, is fixed the cylinder, or barrel *o, o,* which is cloſed at its ends, *p, s,* and is likewiſe divided by two partitions *q, r.* This barrel is made of thin ſplit deal, as are alſo the ends and partitions. *t, t.* is a thin board, or plate of tin or thin iron, faſtened with hinges, that it may be opened to put the ſeed into the three partitions *p q , q r, r s.* In the middle of each of theſe partitions, the barrel is pierced with holes three or four inches aſunder, and about a quarter of an inch diameter. The barrel of the wheels are fixed on an iron axle-tree, ſo that all turn together.

To know whether the holes *u, u, u,* in the three partitions of the barrel are of a proper ſize and number to diſtribute the ſeed in the manner that is deſired, let ſome, ſuppoſe half a buſhel, be put into each partition. The blocks *n, n,* being placed on each ſide between the two ſtandards, whoſe inner ſides are rounded ſo as to fit the groove in the blocks and the table *S S,* being raiſed ſo that the wheels do not touch the ground, any one may eaſily ſee, by giving the wheels a turn or two round with the hand, whether the proper quantity of ſeed drops behind the ſhare; and alter it accordingly.

The barrel being properly fitted, the beam is faſtened to the fore-carriage of this drill. As it moves, the barrel turns with the hind wheels, and the ſeed drops out of the holes *uuu, fig.* 5. into the cavities *a, c, b, fig.* 3, and from thence into the hollow *c, fig.* 2. in the hind part of the ſhare.

When the plowman comes to the end of the field, he lifts up the hind carriage, which is light, and carries it to the next bed that is to be ſown.

* We apprehend that farmers who ſow under furrow, might eaſily contrive to fix ſuch a ball to the handles or hind part of their plough; and that it may be made to turn round, and ſo drop the ſeed, by means of ſmall wheels, or by little eminences on its ſurface. The ſeed would be covered by the next turn of the plough, as uſual. This method will ſave a great deal of ſeed, and yet the field may be ſown ſo that the corn ſhall grow as thick as the ground can bear.

M. Du-

M. Duhamel does not fix the diameter of the hind wheels, but leaves that to be determined by the length of the ſhares. His were ſo proportioned, that when the ſhares touched the ground, the wheels did not touch it by two inches. He obſerves that this drill anſwered extremely well, where the ground was plowed into an even or level ſurface: but that the wheels were too ſmall when the middle of the beds was raiſed; becauſe the ſhares were then on the higher part of the bed, while the wheels were in the furrows.

In *fig.* 3 and 4, are two thin boards *x*, *x*, ſomewhat bending, which riſe up to about half the height of the barrel. The uſe of theſe is to catch the ſeeds that may chance to drop from the oblique holes, and guide them into the cavities *a*, *c*, *b*.

It is well known, that when the fore part of the ſhare terminates in a point, it pierces the deeper in the earth, the farther back the beam is placed on the fore carriage: but as the bottom of our ſhares is round, they pierce neither more nor leſs when the beam is placed more forward. It is therefore adviſeable to place the fore and hind carriage as near as poſſible to one another, becauſe the plough then goes eaſier, and the draught is lighter to the cattle.

This inſtrument is eaſily tranſported from place to place by means of two poles *y*, *z*, *z*, *fig.* 3. The ends *y* are placed on the fore-carriage, together with the beam, and from thence paſs under the table, ſo as to raiſe the whole from the ground, on which their other ends *z*, *z*, reſt. The croſs bar *k*, *k*, ſecures thoſe ends, and keeps them at a proper diſtance.

In the conſtruction of the above inſtrument, as given by M. Duhamel, the ſhares muſt always pierce to the ſame depth, becauſe the whole weight of the hind part of the drill reſts continually upon them: conſequently, it would be neceſſary to have ſhares of as many different lengths, as there are depths at which each kind of ſeed ſhould be ſown.

We apprehend, that when the ſhares have pierced to the depth intended, the weight of the drill may be made to reſt on the wheels, by preventing the axle tree from riſing between the ſtandards, beyond ſuch a height as ſhall exactly regulate the depth to which the ſhares are to pierce. This may be effected, by bringing the ſtandards *i*, *i*, *fig.* 4, nearer to each other; and placing between them, inſtead of the blocks *n*, *n*, *fig.* 5, two thick pieces of wood, made to ſlide up and down, with grooves, as in the blocks. Theſe pieces of wood may be fixed between the ſtandards, by means of two ſtrong iron

 pins

pins run through the ſtandards into them: and to take off the friction of the axle tree againſt theſe pieces of wood, it may be made to turn on two friction wheels, placed in the lower part of them; or rather on four or ſix ſmall iron rollers turning on their axes * in a box inſerted in each of theſe pieces, which may be raiſed, or lower'd, by means of a row of holes in the ſtandards, through which the iron pins are put, ſo as to give the axle tree room to riſe to the height that ſhall be thought neceſſary to make the ſhares pierce to the intended depth, before the weight of the drill ſhall reſt upon the axle tree.

That the axle tree, moving on ſuch rollers, will have leſs friction, or require leſs ſtrength to make the wheels turn round, even when the weight of the whole inſtrument lies upon it, than it has in the blocks, with only the weight of the grain, is evident from the following fact. The gentleman who firſt thought of this invention, applied it to a roller of four tuns weight, which is now drawn with eaſe by two ordinary horſes, even acroſs his plowed grounds.

It appears from this eaſy motion of the roller, that there can be no danger of the axle tree's turning, though loaded with the weight of the whole inſtrument. Other conſiderable advantages will alſo ariſe from the drill's reſting thus on the wheels: for the labour of the plowman will be greatly leſſened, the inſtrument will move ſteadier and more uniformly, and the draught will be much eaſier for the horſes.

M. Duhamel does not ſeem to have provided ſufficiently for covering the ſeed. We think that may eaſily be done, by fixing to the lower ſide of the table, a little behind each ſhare, two thin plates of iron, or two pieces of board, in an angular form, but not quite joined together, thus \/. They ſhould reach, as nearly as poſſible, ſo low down as to be level with the ſurface of the ground when the ſhares have pierced to the depth intended. Their fore part ſhould extend beyond the width of earth that is turned up by the ſhares, which they will collect into the furrow; and being open behind, if they happen at any time to collect more earth than was turned off by the ſhares, it will eſcape through that opening, without clogging the drill.

* Theſe rollers are made in great perfection, by Mr. Stevens, iron-monger, in the Hay-market, London.

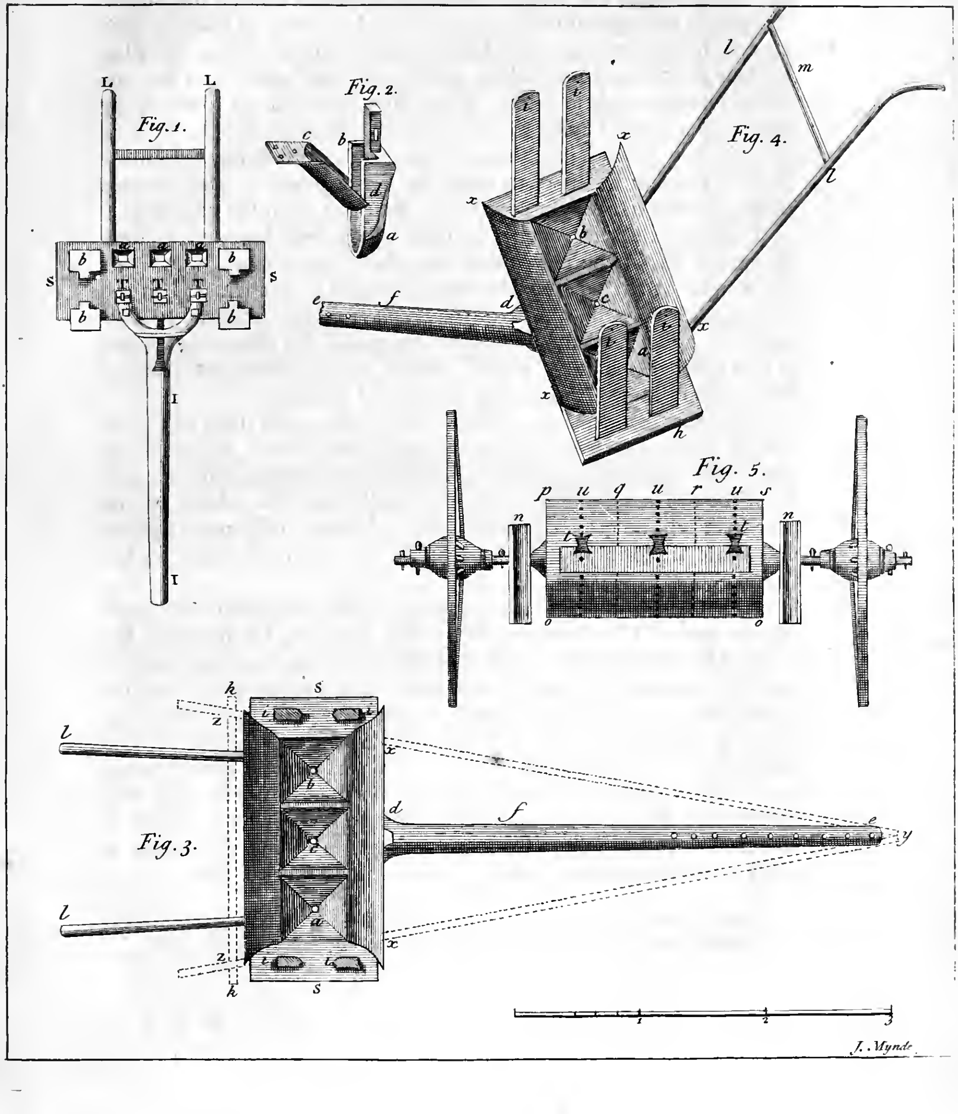
Fig. 1.
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Fig. 5.
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J. Mynde

CHAP. III.
Of HORSE-HOES.

SECT. I.
Description of M. Duhamel's *Light Plough.*

THE design of stirring the alleys has been so often, and so fully explained in the former parts of this work, that it would be needless to enlarge upon it further here. We shall therefore proceed to give a description of the instruments used for this purpose, beginning with M. Duhamel's light plough.

The hind part of this plough is exactly like that of a common plough, except that all the pieces of which this is composed, are lighter.

A B Pl. VI. *fig.* 1. is the beam of the plough: *A* is what is called the heel. The part of the beam from the coulter to *B* is round: the rest of it, to *A*, is eight square.

C, the coulter, which is fixed in the beam by wedges. The beam is strengthened on each side of the coulter, by two iron hoops.

D, the handles, which are joined to the beam towards their bottom, and of which the lower extremity is fixed into a piece of wood *AE*, called the ground-rest. This last terminates in a point a little beyond *E*, in order to receive the iron share *F*, which that extremity of the ground-rest is covered with. *G*, is the sheat, which is cut forked out of a piece of elm, and of which the two ends are fastened with a wooden or iron pin over the ground-rest, as at *E* on the left side.

H, is a piece of wood, the fore part of which is thinned to an edge: the upper part of it is fixed to the beam, and the lower part to the ground-rest.

G I H is a board cut somewhat rounding, and placed on the right hand side of the plough. It is called the mould-board; and its use is to turn over to that side, the earth which has been cut by the coulter, and opened by the share.

Underneath *H*, is a piece of wood which serves to support the mould-board in the middle, to prevent the pressure of the earth from bearing it down upon the plough.

The bottom of the ground-rest, from *E* to *A*, is trimmed with iron,

iron, to prevent its being worn by the continual friction of the earth.

This general defcription feems fufficient: for we believe one may ufe indifferently any common plough that has a mould-board, provided the fore-carriage and wheels be taken off, and two fhafts fubftituted in their ftead, like the following.

K L, are two light fhafts, which are faftened together by the crofs ftaff *M N*, at fuch diftance as to leave convenient room for a horfe.

OP, is another crofs ftaff, the ends of which reft upon the fhafts, to which they are faftened by two iron pins. The end of the beam refts upon this crofs ftaff.

It is eafy to conceive, that the nearer this crofs ftaff *O P* is fet to the other crofs ftaff *M N*, the deeper the fhare will penetrate into the earth: and the farther thofe ftaves are afunder, the lefs deep the plough will pierce. Either of thefe is eafily done, by fhifting the pins of the crofs ftaff *O P* to the fuitable holes in the fhafts.

Q R is the neck of this plough, which receives the beam through a round opening, wherein it turns with eafe to the right hand or the left, but out of which it cannot flip, becaufe it is ftopt by a ftrong iron pin driven through it.

This neck is formed of two femi-cylindrical pieces of wood, which are preffed one againft the other by two fcrew trunnions; and two other trunnions *Q, R*, fix this cylinder to the ends of the fhafts.

As the cylinder turns upon the trunnions at its ends, the pofition of the beam may of courfe be altered at will, fo as to make the fhare cut more or lefs deep into the earth: and as the beam can turn in its neck, the plough may be inclined more or lefs to the right or left; which is neceffary in order to plow well.

SECT. II.

Defcription of M. de Chateau-vieux's *Single Cultivator.*

AFTER having feen, fays M. de Chateau-vieux, the effects of my plough for ftirring the alleys between the rows of corn, I imagined that the inftrument I am going to defcribe, which is much lighter and more fimple in its make, would anfwer the fame end; or at leaft that it might be ufed alternately with the plough, employing this

this laſt only when a greater quantity of earth is wanted to be turned up towards the rows of corn: for it is to be obſerved, that the *cultivator* hardly changes the ſituation of the earth, but divides and breaks it in the place it is in, ſo as to render it looſe and light, and fit for the roots of plants to penetrate with eaſe. This inſtrument, like a miner, works chiefly under ground, where it cuts the earth, divides its particles, and raiſes it up and lightens it. It has this farther advantage, that one horſe is ſufficient to draw it. The cultivator, *Plate* VI. is compoſed of a beam *A B*, *fig.* 2. the handles *C D*, and the ſhare *E F*, which is more particularly repreſented in *fig.* 3, 4, 5, 6, and 7.

The beam *A B* is three feet and a half, or four feet long. It's diameter ought not to exceed three inches, at moſt: and if it be ſquare, the edges ſhould be rounded off. It ſhould be pierced with the mortiſes under the letters *G*, *H*, in order to let through the croſs ſtaves *I*, *L*, in the ſame manner as in the fore-carriage of the plough; and is fixed by the keys *K*, *M*, or the pins *a*, *b*. The middle of the handles ſhould be over-againſt the beam, that is to ſay, the ſpaces between them ſhould be equal on both ſides. Theſe handles ſhould be made ſlighter than the plough itſelf, and they ſhould be fixed to the beam by a tenon in a mortiſe, rivetted at *N*, and ſupported behind by the prop *P*.

The extremity *A* of the ſhare, *fig.* 4, and the two fins *B*, *C*, are made flat. The crooked handle *A B C*, *fig.* 5, ſhould be quite triangular, and ſomewhat ſharp before, to anſwer the end of a coulter, as in *fig.* 3 and 6.

This ſhare is to be let into a notch cut in the under part of the beam, as repreſented in *fig.* 8 and 9; and faſtened there by a ſingle ferrit, as in *fig.* 10. If it ſhould cut too deep, that may be remedied by altering the poſition of the wheel, as in the plough, or by inſerting a very ſmall wedge *g*, *fig.* 11, between the handle of the ſhare and the beam. If it does not cut deep enough, that wedge muſt be inſerted at *h*, *fig*, 12, at the other end of the handle, by the hook.

When this inſtrument is uſed, the beam before deſcribed is to be ſubſtituted in the place of that of the plough, which is to be taken off. The two croſs ſtaves *I*, *L*, *fig.* 2. of the fore-carriage of the plough, are then run through the mortiſes *G*, *H*, of the beam, by which means it is fixed thereto. This cultivator is very eaſy to guide; the plowman may hold it upright, or incline it to the right or left,

juſt

just as the intended plowing may require. The ſhare and its handle enter ſo deep into the earth, as to be quite buried in it, if a deep plowing is intended to be given: and in that caſe the tail *A* of the beam touches the ground. Tho' the ſhare is but ſmall, it ſtirs the earth at leaſt a foot round it: its point ſhould be of ſteel, and ſomewhat inclined towards the earth.

The ſhare of this inſtrument, like that of the plough, may be brought as near as one pleaſes to the rows of corn, by placing the beam accordingly in the frame.

SECT. III.

Deſcription of M. de Chateau-vieux's *Double Cultivator.*

THIS inſtrument, *fig.* 13 and 14, has two ſhares. It has a beam *A B*, and the ſhares *C D*, *E F*, which being exactly like that of the ſingle cultivator, I have only to point out wherein theſe inſtruments differ. The beam of this, ſhould be 10 or 12 inches longer than that of the other. It has likewiſe two mortiſes more, under the letters *G* and *H*, to let through the croſs ſtaves *E K*, *I L*, which bear the handles *M N*, *O P* of the ſhares. The croſs ſtaves *E K*, *I L*, are rivetted permanently to the beam: the handles *M N*, *O P*, are moveable upon the croſs ſtaves, to which they are faſtened by the keys *R*, *S*, *Q*, *T*; ſo that the ſhares may be ſet at a greater or leſs diſtance from each other, according as the quality or ſituation of the ground may require or allow.

This inſtrument ſtirs the earth extremely well, and does a great deal of work in a little time. Each ſhare being about fifteen inches wide at *A C*, *B D*, *fig.* 15, and the diſtance between them from *A* to *B*, *fig.* 15, being about four inches, or, upon occaſion, ſix; and the earth being ſtirred about two inches on each ſide beyond the extent of the outmoſt fins of the ſhares; each cut of this cultivator ſtirs about two feet breadth of ground. This double cultivator requires two horſes, unleſs the ſoil be very light; in which caſe, I fancy one may do, tho' I have not yet tried it.

If one had a mind to fix a coulter in the middle of the beam, juſt before the ſhares, I ſee no inconveniency that could attend it, provided it be a very light one.

The way to uſe this cultivator, is, to faſten it to the fore-carriage of of the plough, by running the two croſs ſtaves *V*, *X*, *fig.* 14, through the beam *A*, *B*.

I would particularly recommend, not to make the wood-work of this cultivator too thick or heavy, and therefore by no means to exceed the dimenſions I have given: for the lighter theſe inſtruments are, the more eaſily they are managed both by men and cattle.

SECT. IV.

Deſcription of M. de Chateau-vieux's *Cultivator with two mould-boards.*

IF, ſays M. de Chateau-vieux, I could have imagined, that my propoſing for the uſe of the new huſbandry, ſome other inſtruments beſides the plough, properly called, could have been looked upon as either ſo expenſive or ſo troubleſome as to diſcourage people from practiſing that huſbandry, I ſhould by no means have thought of communicating them to the public.

But why ſhould not agriculture enjoy the ſame advantages as almoſt all great manufactories, in which every uſeful diſcovery and improvement, either to perfect the manufacture, or to fabricate it in leſs time and with leſs expence, is readily adopted?

It is likewiſe with a view to facilitate the various labours of cultivation, to execute them better, more ſpeedily, and with much leſs expence, that I have introduced the uſe of my new inſtruments in the culture of my lands. If others think proper to do ſo too, they will enjoy the ſame advantages. I offer them, not as things abſolutely neceſſary, for the plough alone may ſuffice, but as things of which I have experienced the good effects during the years 1753 and 1754; and which, for that reaſon, I think it incumbent on me to recommend to the partiſans of the new huſbandry.

The cultivator with two mould-boards, differs from the ſingle cultivator before deſcribed (SECT. II.) only in thoſe two mould-boards which I have added to it, one on each ſide, and which are repreſented in *Plate* VI. *fig.* 16. *A*, *C*, *E*, *H*, is the mould-board on the left hand ſide of the plough, and *B*, *D*, *G*, *H*, the mould-board on the right-hand ſide. The whole of this *fig.* 16, repreſents an entire and a perſpective view of the ſhare and mould-boards.

The mould-boards are made of iron plates, either caſt or hammered, about the twelfth part of an inch thick, which is ſufficient to reſiſt the preſſure of the earth. Thicker plates than theſe would render the ſhare too heavy, and it would be much more difficult to give them their proper bent.

The two mould-boards join to the handles at *H L*, and lap about an inch one over the other; or elſe they are faſtened together by rivets. They form, in that part, an angle *E, H, F*, of ſomewhat leſs than 90 degrees, which is ſufficiently acute to ſerve inſtead of a coulter: tho' a coulter may alſo be uſed upon occaſion, by placing it a little more forward.

From the lower part *L* of the handles, the mould-board ſhould paſs underneath the fin *L, G*, of the ſingle ſhare, and follow the direction of that fin, as at *G*; being let in beneath, about an inch and an half, according to the pointed line *L, G*, and firmly riveted by three ſtrong rivets.

The hind part of the mould-boards is fixed and ſupported by the ſtay *F*, to which they are ſtrongly riveted. This ſtay muſt have exactly the ſame bend as the mould-board.

Behind the lower part of the handles is another ſtay, *M, N*, quite cloſe to them, and about two inches below the top of the mould-boards, to which it is riveted at both ends. This ſtay helps to keep them firm: but its chief uſe is to prevent their being raiſed up by the preſſure of the earth againſt their extremities *A* and *B*, which would throw their common angle *H* too forward, and miſplace the ſhare.

The proper ſlope of the mould-boards cannot be ſo well deſcribed by words, as it may be conceived by the figure, which repreſents at *F* the convex inſide of the one, and at *Q* the concave outſide of the other. The diſtance to which the earth is turned over, when the cultivator opens it in order to make a large furrow, depends on the degree of this bending, and the ſpace between the two upper extremities of the mould-boards, *E, F*.

The extreme back part of the mould-boards is cut ſloping at *C* and *D*, almoſt in a ſegment of a circle: this ſhape helps to operate a greater diviſion of the earth.

The plate of iron, before it is bent, ſhould be cut nearly in the ſhape of *fig.* 17.

The ſize of the mould-boards, as well as the proper bending of them, depends a little on the quality of the land intended to be cultivated. I have found that, for light ſoils, they need not be bent quite

quite so much; so that the distance from C to D, *fig.* 16, may be twelve or thirteen, and even fifteen or sixteen inches. This same cultivator may likewise be used in stiff lands.

Nothing hinders making these mould-boards two or three inches longer, from B to G, and from E to H; nor varying some of their proportions, as the plowman may like best.

This share, with the mould-boards, is fixed to a beam, as in the single cultivator *fig.* 2, where it is fastened to the fore carriage by the cross staves I, L.

If this description does but convey a sufficiently clear idea of the shape and proportions of this cultivator, I will answer for its success when used. I describe it after one of the same kind, which I have made use of for two years past, with very great success.

Directions for using the Cultivator with two mould-boards, by M. de Chateau-vieux.

IN my account of the experiments of 1753, I said that this cultivator opened the great furrow in the middle of the alley, by turning the earth over on both sides at the same time; and that as much work was done by that means, by one turn of this instrument, as could be done by two, and frequently three turns of the common plough, and that without using a greater number of cattle. I must now prove this proposition; tho' I am persuaded that it will easily be allowed by whoever only casts an eye on *fig.* 16, *Plate* VI, which represents the share of this cultivator.

The vacant space between the outmost row of corn on one bed, and the nearest row to it on the next parallel bed, which is what we have called the alley, and which is not sown at all, is the part that is to be cultivated at different times, from the first sprouting of the corn, till it is ripe.

The practice of the new husbandry has already shewn sufficiently, that too narrow alleys would scarcely answer any of the ends they are intended for; and that making them too wide, is a loss of ground. About four feet, exclusive of the spaces or partitions between the rows of corn in the beds, is a good middling width.

It is less necessary to make the alleys quite so wide in good soils: nor indeed do I think four feet so absolutely necessary at any time, but that a few inches less may do. An intelligent husbandman will easily judge what is most proper to be done in this respect. But what greatly merits the attention of every one, and ought never to be loſt ſight of, is, that wide alleys are more eaſily and much better ſtirred than narrower ones: for when an alley is wide, the great furrow in the middle of it may be cut deep, there being then ſufficient ſpace to turn the earth over towards the rows; whilſt on the contrary, in too narrow alleys, the earth cannot be ſtirred deep enough, nor can room be found for what is turned over out of the furrows, without danger of burying great part of the rows.

I therefore ſuppoſe the general width of the alleys to be about four feet. But the whole of that width is not to be plowed or ſtirred, either with the plough or cultivator, as ſoon as the field is ſown. Neither of theſe inſtruments ought to go too near the rows of corn, for fear of rooting up the plants: but a ſlip of earth, about ſix inches wide, ſhould be left untouched on the outſide of each bed; by which means the part of the alley that is to be ſtirred, will be reduced to the breadth of three feet; and even that is leſſened in the firſt plowing before winter, by a deep furrow which is then cut cloſe to and all along thoſe ſix-inch ſlips, and the earth taken out of that furrow, or thoſe furrows, is thrown into the great furrow in the middle of the alley, and ſerve to fill and arch it up. Theſe two ſide furrows make together a width of about eighteen inches, and conſequently leave in the middle of the alley a breadth of about eighteen inches more, on which is heaped up the earth thrown out of the two furrows: and thus the alleys remain all the winter.

The firſt hoeing in the ſpring, ſhould turn back towards the rows of corn, the earth heaped up in the middle of the alleys. The two furrows that were opened before winter, are then filled up, and a new one is cut in the middle of the alley.

To perform this firſt hoeing with the common plough, which may very eaſily be done, two turns of that inſtrument will neceſſarily be requiſite, *viz.* one on each ſide of the alley, as near as poſſible to the beds. But as even with thoſe two turns, the furrow will frequently not be well formed, but a great deal of earth will ſtill remain between it and the bed, a third turn of the plough is often neceſſary, and ſometimes a fourth, to form the middle furrow as it ought to be.

To perform this work with the cultivator with two mould-boards, that inſtrument muſt be placed in the middle of the alley, and the horſes in one of the two furrows. The ſhare will eaſily enter, and

to

to a great depth, into the earth that was laid there by the laſt hoeing before winter: and as the horſes advance, that great ridge of earth will be divided into two parts, which will be turned over into, and will fill up the furrows that were made before winter on each ſide of the alley, cloſe to the beds. Thus, the great furrow in the middle of the alley will be opened, and the whole operation performed by one turn of the cultivator. The earth ſo turned over will be thoroughly ſtirred, and ſo much time and labour will be ſaved by this method, that the farmer may eaſily afford one or two ſtirrings more in the ſummer, which will always be of great ſervice.

I have found ſo much benefit from making the furrow in the middle of the alley very deep, that I have ſometimes given it a ſecond plowing with the cultivator with two mould-boards, eight or ten days after the firſt; by which means I have cut it ſo deep, that I have been ſure of having a depth of fifteen or eighteen inches of well looſened mould under the middle of my next year's beds.

My lands have been brought to ſo fine a tilth by the plowings of former years, that I have not had any occaſion for a coulter to my cultivators: however, it may be proper to uſe one, where the ground has not been ſufficiently looſened by the preceding culture.

To ſhew to what degree of pulveriſation my lands have been brought, and how extremely light they now are, I ſhall only mention the following fact. I uſed only one and the ſame cultivator with two mould-boards during the whole courſe of the years 1753 and 1754, and never had occaſion even once to have the ſhare new pointed. The friction and reſiſtance of the earth were ſo little in my grounds, that the point of my ſhare was not worn at all, whilſt, in the ſame years, my neighbours were obliged to have the ſhares of their common ploughs new pointed almoſt every day.

SECT. V.

Deſcription of M. de Villiers's *Cultivator.*

THIS inſtrument is compoſed of a ſhare, *Plate* VI. *fig.* 18, the two fins of which are eight inches and a half wide at their extremities *a*, *b*. The ſocket *c*, which is between the two fins, projects ſome inches, and the hollow in it is three inches long, and one inch wide. It does not deſcend ſo low down as the fins, to prevent its touching the earth. The length of this ſhare, from the point *d*, to the extremity of the fins *a* or *b*, is from 12 to 13 inches. Five inches from the point *d*, is a hole *e*, into which is inſerted the crooked point *f*, of the iron ſafeguard, *fig*. 19, which is uſed in this country in order to faſten the ear to the ſhare of the plough. Upon the ſhare is placed a ſmall triangular ear *b*, *fig*. 21, 22, and 23; ſomewhat concave at bottom, that the two ſmall ears may join exactly to the ſhare at about an inch diſtance from the edge of the fins. This ear is about two inches and a half high at *a*, *fig*. 22, and is faſtened firmly to the ſhare by a double and angular ſafeguard, which covers its edge as far as *b*. It is fixed at one end by its point, which enters into the hole *e*, *fig*. 18, in the ſhare, and by four ſmall pins faſtened to the ear. *Fig*. 19 and 20 repreſent this ſafeguard. The double ear is faſtened at its other extremity, by the ſheat, or upright piece *e*, *g*. *fig*. 22, which paſſes through the ground-reſt of the hinder part of the ear and beam, and by a piece of iron *c d* bent in a right angle. This piece of iron covers the fore part of the ſheat, and reſts upon the tail of the ear, againſt which the beam preſſes it very tight, by means of a wedge *e*, driven into the ſheat. The piece *c d* may likewiſe ſerve to fix two mould-boards from *g* to *c*. It is nine inches high. *f* is another ſheat or upright piece, which joins the beam to the ground-reſt, to add to the ſtrength and ſolidity of the inſtrument, which is increaſed alſo by the lower part of the handles being fixed in the ground-reſt at *i*, and traverſed by the beam at *k*.

M. de Villiers, in a letter to M. Duhamel gives the following account of his manner of uſing this cultivator.

" Finding it, ſays he, impoſſible to plow my alleys well when " they were but three feet or three feet and a half wide, without " greatly damaging the rows of corn bordering on them, I reſolved " to make them four feet wide, and took particular care to have the " rows drilled very ſtrait. Even then, I found but one way of " plowing them well, which is, to open the firſt furrow ſo near the " bed, that the next furrow within that may come within two or " three inches of the neareſt row of plants in the bed, turning over the " earth of theſe furrows towards the alley. After two or three ſuch " turns of the plough, the plowman will be ſure not to make any " miſtake. It is of great importance to cut this firſt furrow, by " which all the others are directed, quite parallel to the rows. The " reſt of the work will then go on regularly, and without any of " that confuſion which would be capable of giving many people a

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to the extremity of the fins *a* or *b*, is from 12 to 13 inches. Five inches from the point *d*, is a hole *c*, into which is inserted the crooked point *f*, of the iron safeguard, *fig.* 19, which is used in this country in order to fasten the ear to the share of the plough. Upon the share is placed a small triangular ear *b*, *fig.* 21, 22, and 23; somewhat concave at bottom, that the two small ears may join exactly to the share at about an inch distance from the edge of the fins. This ear is about two inches and a half high at *a*, *fig.* 22, and is fastened firmly to the share by a double and angular safeguard, which covers its edge as far as *b*. It is fixed at one end by its point, which enters into the hole *c*, *fig.* 18, in the share, and by four small pins fastened to the ear. *Fig.* 19 and 20 represent this safeguard. The double ear is fastened at its other extremity, by the sheat, or upright piece *e g* *fig.* 22, which passes through the ground-rest of the hinder part of the ear and beam, and by a piece of iron *c d* bent in a right angle. This piece of iron covers the fore part of the sheat, and rests upon the tail of the ear, against which the beam presses it very tight, by means of a wedge *e*, driven into the sheat. The piece *c d* may likewise serve to fix two mould-boards from *g* to *c*. It is nine inches high. *f* is another sheat or upright piece, which joins the beam to the ground-rest, to add to the strength and solidity of the instrument, which is increased also by the lower part of the handles being fixed in the ground-rest at *i*, and traversed by the beam at *k*.

M. de Villiers, in a letter to M. Duhamel gives the following account of his manner of using this cultivator.

"Finding it, says he, impossible to plow my alleys well when they were but three feet or three feet and a half wide, without greatly damaging the rows of corn bordering on them, I resolved to make them four feet wide, and took particular care to have the rows drilled very strait. Even then, I found but one way of plowing them well, which is, to open the first furrow so near the bed, that the next-furrow within that may come within two or three inches of the nearest row of plants in the bed, turning over the earth of these furrows towards the alley. After two or three such turns of the plough, the plowman will be sure not to make any mistake. It is of great importance to cut this first furrow, by which all the others are directed, quite parallel to the rows. The rest of the work will then go on regularly, and without any of that confusion which would be capable of giving many people a dislike

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" dislike to the new husbandry. My horses were led by hand, till " they were sufficiently accustomed to this work: but that was ne- " cessary only for the first furrow, which they afterwards follow of " their own accord, by which means the rest of the alley is plowed " with great ease.

" The earth of the second furrow, which is cut very near the " rows, is turned over in the same direction as that of the first; that " is to say, from the bed.

" The third furrow is plowed the contrary way, and the earth is " now turned over towards the rows, so that the last furrow is filled " up by this, and a considerable quantity of well divided earth is " turned over to the rows, for the plants to extend their roots in " the spring.

" I then continue plowing in the same direction, cutting the fur- " row that is turned over towards the rows as thick as possible, till " the whole alley is plowed almost close to the opposite bed, when, " by turning over one large furrow on that side, the small one cut " there at first is filled up. By this means, the first spring hoeing is " completely executed.

" I begin the second plowing on the side where I ended the first, " turning the earth over that way, which is the contrary of what " was done before: and when I come to the other side of the alley, I " leave there, as was left before on the side I now begin at, the width " of a small furrow, which I do not plow, but over which I turn " the earth of my last furrow.

" I think this second hoeing may be deferred, when the ground " does not produce many weeds: and in this case I perform it with " the cultivator, which I bring almost close to the rows.

" After thus using, sometimes the plough, and sometimes the cul- " tivator, according as the condition of the ground seems to require, " I finish all my hoeings by fastening two horses to the cultivator, " and drawing it once or twice through the middle of the alleys; " because it cuts four or five inches deeper than the plough."

M. de Villiers adds, that he could not always turn the earth over towards the rows, as M. Duhamel directs, because the wheel of his plough, getting too deep in the middle furrow, altered the direction of the share. To this M. Duhamel observes, that he himself met with the same difficulty, and found no other way of remedying it, but by opening a small furrow near the rows, by the help of which he turned the earth over towards the alleys, and then filled up that furrow

furrow immediately, taking care at the ſame time to turn the mould over to the roots of the plants, ſo as to earth them up as much as poſſible. " I am glad, adds he, that I have had this opportunity " of giving M. de Villiers's method, becauſe I think it a good one, " and believe it will be of great ſervice to ſuch as may be inclined to " practiſe our new huſbandry."

Obſervations on Horſe-hoeing, by M. de Villiers.

" I Have tried, ſays this gentleman, to hoe my alleys after M. " de Chateau-vieux's method, which I look upon as the beſt and " moſt expeditious, notwithſtanding that ſeveral difficulties which I " have met with in the practice of it, have obliged me to give it up. " For example, the great furrow in the middle of the alley is, ac- " cording to his directions, to be filled up by two turns of the plough, " one on the right hand, and the other on the left, after which it is to " be opened again by one turn of the cultivator with two mould- " boards, or two or three turns of the common plough.

When I ſet about this work, the firſt turn of the plough, if the " ſhare went to any depth worth ſpeaking of, always filled up the " furrow in ſuch manner, that to prevent its being poached by the " horſes, I tried to make them walk on one ſide, on the upper " ground, and conſequently very near the rows of corn: but then, " in the firſt place, I could not avoid the deſtruction of a great num- " ber of plants, without giving ſuch attention as was not only ex- " ceſſively troubleſome, but almoſt impracticable: and ſecondly, I " could plow only the ſurface, becauſe as the furrow was filled, the " plough could turn up but very little earth, without being choaked, " and becoming extremely heavy.

" If, to ſave the plants, I made the horſes tread partly on the " mould turned over into the furrow, the plough choaked equally, " and for the ſame reaſon, whenever the furrow was cut deep. " All I could do in this caſe, was to give only a ſuperficial plowing: " and with that it was impoſſible to uſe the cultivator with two " mould boards, to form the furrow, becauſe that inſtrument cannot " operate in any but a looſe well-tilled ground.

" All theſe inconveniencies may not happen in a ſoil different from " mine. I am the more inclined to think this, as M. de Chateau- " vieux certainly does not experience them: but at the ſame time I " muſt alſo obſerve that that juſtly celebrated gentleman has inſtru-

ments

" ments ſo perfect, and directs his ſervants with ſuch ſuperior judg-
" ment, that few can expect eaſily to equal him in the practice of the
" new huſbandry.

" Not being able, for the above reaſons, to do with one turn of
" the cultivator with two mould boards, what, as M. de Chateau-
" vieux himſelf obſerves, can frequently not be done with leſs than
" three or four turns of the common plough, which, added to the
" two turns that are given to fill up the furrow, make in all five or
" ſix turns; I purſued, and with great advantage, nearly the method
" before deſcribed. I ſay nearly that method, becauſe I have made
" ſome few alterations, by which I think it is rendered both eaſier
" and better.

" 1. I make the mould-board twelve or thirteen inches deep, in-
" ſtead of nine or ten that it was before. The furrows are by this
" means made wider, and the plough is more eaſily drawn, becauſe
" it finds more room to diſcharge its load of earth in, and ſuffers leſs
" preſſure.

" 2. To give the ſecond hoeing with the plough, inſtead of con-
" tinuing to turn the earth over towards that ſide of the alley where
" I turned up but one furrow when I finiſhed the firſt plowing, I,
" on the contrary, begin this ſecond at that furrow, approaching, if
" poſſible, to within two or three inches of the row of corn; and
" then I make a furrow in the contrary direction, which turns the
" earth up againſt that row.

" My reaſon for plowing ſo near the rows, when I give this ſecond
" hoeing, is, that I have obſerved that the rains which fall pretty
" frequently in the ſpring, between the firſt plowing and the ſecond,
" harden the earth greatly, and that drought afterwards hardens it
" ſtill more, ſo that the roots of plants can no longer pierce or
" ſpread in it with eaſe: and yet nothing is more neceſſary, in order
" to their being benefited by every culture of the earth, than that
" they ſhould find an eaſy paſſage into the mould that lies next the
" rows. It is therefore highly proper to ſtir that mould, when the
" ſecond hoeing with the plough is given, which, with me, is when
" the corn has begun to ſpindle: that being the time when the plants
" puſh with the greateſt ſtrength, and when their roots ought con-
" ſequently to begin to extend to ſome diſtance.

" I have not perceived that the plants have been at all hurt by the
" plough's coming ſo near them. They ought to be ſo much the
" leſs hurt thereby, as the rows are placed over a furrow which has

" been cut deep; that ſituation being alone capable of making the
" corn tiller, and puſh ſtrongly: though the aſſiſtance of culture is
" likewiſe neceſſary, to ſupply the ſtalks and ears with plentiful nou-
" riſhment.

" I am the better pleaſed with this method of bringing the hoe-
" plough almoſt cloſe to the rows, as it facilitates a very important
" operation, ſtrongly recommended by M. Duhamel, and which I
" never before thought practicable: I mean, the raiſing up of the
" earth about the bottom of the plants, as well to give them greater
" nouriſhment, as to prevent their being lodged. The following is
" my method on this occaſion.

" When I fill up the furrow which I have cut as cloſe as poſſible
" to the row, I hold the plough ſloping, in ſuch manner that the
" earth is forced away from it, and is raiſed up about the plants.
" If this ſlope is not ſufficient, which may ſometimes depend on
" the condition of the ground, or the dexterity of the plowman, I
" in that caſe make the mould-board two or three inches wider,
" when I uſe it to fill the furrow, than it was when I made that
" furrow: and to that end I ſcrew on to the extremity of the mould
" board, a thin plate of iron about four or five inches wide. Thoſe
" who practiſe the new huſbandry in ſo extenſive a manner as to em-
" ploy ſeveral ploughs, will find no inconvenience in having one,
" larger than the reſt, purpoſely for this important operation. As
" I do not give this ſecond hoeing with the plough, till after the
" corn has begun to ſpindle, it is eaſy for me to avoid burying the
" plants, eſpecially if there are no great clods in the ground: but at
" all events I always earth the plants up as much as poſſible, when
" there is no other danger than that of burying here and there a few
" of them, becauſe that accident is eaſily remedied afterwards, if it
" be worth while.

" When I am to give the third hoeing with the plough, I con-
" ſider the condition of the ground. If it is in good tilth, well
" looſened, and free from weeds, I uſe only the cultivator: other-
" wiſe I uſe the plough, three or four turns of which are ſufficient
" to perform this operation, in the following manner.

" The firſt cut, turns the earth over into the middle furrow: the
" ſecond and third are in a contrary direction, and the fourth takes
" up what was looſened by the third, whereby the furrow is repla-
" ced in the middle of the alley. Some time after this, and eſpe-
" cially if a ſhower of rain has fallen, I cut that furrow ſtill deeper,
" by

" by one turn of the ſingle or double cultivator, as M. de Chateau-
" vieux directs.

" But as, even after all theſe plowings, the great furrow may
" chance to be neither deep enough, nor ſufficiently cleared of mould,
" owing either to the imperfection of the inſtruments made uſe of,
" or to the inaptitude of the plowman, that defect may eaſily be
" remedied after harveſt, by giving one plowing more, which is to
" be begun by throwing up the earth to the right hand and the left,
" towards the ſummit of the beds, that is to ſay, over the ſtubble.
" This practice is alſo confirmed by M. de Chateau-vieux's in-
" ſtructions.

" The one plowing extraordinary which this operation requires,
" ought not to be thought much of, because the moſt important
" thing in the new huſbandry certainly is, the providing of a good
" depth of well ſtirred mould, for the plants to extend their roots
" in."

CHAP. IV.

Of GRANARIES.

THO' we are not, in this kingdom, under the ſame neceſſity as ſome foreign countries, of building large edifices for granaries, becauſe our harveſts are much leſs apt to fail us; yet, as it muſt be of great advantage to every farmer to be able to preſerve his corn of all kinds from inſects and putrefaction, we think it will be right to give ſome directions for this purpoſe, which it may be in the power of any one to put in practice: referring thoſe who can afford to be at a more conſiderable expence, to the larger means pointed out by the writers on this ſubject. Among theſe, the firſt place is moſt deſervedly given to that beneficent friend to mankind, the Rev. Dr. Hales. M. Duhamel has more particularly applied the uſe of ventilators to the preſervation of corn, and has likewiſe added the uſe of ſtove-granaries. As the erecting of theſe laſt is attended with an expence which the generality of farmers can ſeldom be at, the kiln may be ſubſtituted in their place: and in regard to public granaries, we recommend to the peruſal of the curious, as well worthy their attention, an ingenious performance * lately written on that ſubject, by a lady of our own country.

* A plan for erecting public granaries.

The editors of Mr. Lisle's husbandry having given a concise abridgment of the experiments in M. Duhamel's treatise on the preservation of corn, we shall copy from them what is most essential therein, and then add the farther experiments mentioned by that gentleman in his treatise on agriculture.

M. Duhamel caused a case or little granary to be made, of oak plank two inches thick, forming a cube of five feet every way. At six inches from the bottom, he made a flooring, or second bottom, of lattice work, placed upon joists of five inches thick, covering it with a strong canvas: and this little granary was filled quite full of good wheat. It contained ninety-four cubic feet, weighing five thousand and forty pounds.

This granary being filled quite full of corn, is to be covered with good oak planks, so closely joined, that neither rats, mice, or even the smallest insect can get in; leaving only some vent-holes, with trap-doors, or covers fitted very exactly to them, which will be spoken of hereafter.

By this means, the corn is deposited in a small compass, and perfectly secured from rats, mice, birds, and even insects, provided there were none before in the granary, or among the corn: but if there should, the means hereafter pointed out will destroy them.

It is well known that, in this climate, corn laid up in great heaps will soon ferment and spoil: to prevent which, it is necessary to force out the tainted air, and supply its place, from time to time, with fresh: in short, to establish a current of air, which shall pass through the corn, and carry off the dampness. To this end, M. Duhamel made a false bottom of lattice work, covered with coarse canvas, (but if it were for a large granary, wire, in the manner of a sieve, might do better,) through which the air could pass, and be forced out at the vent holes at top.

This purpose is answered by bellows, and the most proper for this end are those contrived by doctor Hales, they being constructed without leather, or any other matter liable to be destroyed by vermin.

A large pair of these bellows being so fixed as to receive the air from without, and convey it between the bottom and false bottom of the granary; when you would ventilate the corn, open the vent-holes at top, and work the bellows, which will drive the air through the whole body of the corn with such force as to make the dust fly

out

out at the vent-holes, and when confined to one ſmall opening will blow up ſome grains of corn a foot high.

The corn I choſe for this experiment, continues M. Duhamel, was of good quality. I ventilated it not more than ſix days in a year, without the help of fire; which was ſufficient to keep it ſo well, that the beſt judges allowed it to be as good as could be.

When the bellows had not been worked for ſome months, the corn was allowed, by good judges, to look and ſmell perfectly well: but they objected that it did not handle well, that is, that it had ſome little dampneſs in it. The bellows were worked for half a day, and that objection was entirely removed.

In hot countries, corn may be preſerved a long time by being depoſited in a vault or ciſtern, ſo cloſely ſtopped, that the air can have no acceſs: but experience ſhews, that this method will not ſucceed in our climate, the ſun not having power to exhale the moiſture from the corn, ſufficiently to prevent its fermenting when laid in a large heap: and this is farther proved by ſeveral experiments of corn dried in a kiln, which, tho' its weight was conſiderably diminiſhed, did not loſe the vegetative quality, but grew very well.

From theſe obſervations it follows, that it is neceſſary to take away the ſuperfluous moiſture, and bring our corn to the ſame degree of dryneſs as that of the hotteſt countries, in order to preſerve it in great bodies.

Experiments on ninety-four cubic feet of wheat (not dried) which was preſerved above ſix years by ventilation only.

IN May, 1743, ninety-four cubic feet of wheat was put in one of the little granaries before-mentioned. It was of the harveſt of 1742, and of an excellent quality, perfectly clean, and ſo dry, that it loſt only one-ſixteenth of its weight upon drying a ſmall quantity of it, for a trial, on a kiln with the heat at fifty degrees of M. de Reaumur's thermometer. This wheat was well cleaned from duſt, and depoſited in the granary without being dried by fire.

The firſt three months, it was ventilated for eight hours once a fortnight: the reſt of the year 1743, and all 1744, it was ventilated once a month: all the year 1745, and part of 1746, it was ventilated half a day once a month; and after that, but once in two or three months.

In June 1750, the granary was emptied, and the wheat look'd and ſmelt very well, but felt a little rough in the hands, becauſe, not having

having been moved for ſix years, the little hairs that are at the extremity of the grains, and the particles of the bran, were roughed up: but after paſſing twice through the wind ſcreen, that objection was entirely removed, and it was found by the bakers, paſtry-cooks, &c. to be perfectly good.

This was corn of eight years old, ſeven of which it was preſerved in the granary, without any ſenſible diminution, and without any damage from rats or other animals: it cannot be ſaved without any expence, becauſe a man was employed from time to time to ventilate it: but it is very eaſy to reduce that expence almoſt to nothing, as will be ſhewn hereafter.

The Rev. Dr. Hales propoſes the following method of preſerving corn, as a thing that may be very beneficial to the poor, who frequently keep ſmall quantities of corn in ſacks.

" Provide a reed-cane, or other hollow ſtick, made ſo by glewing " together two ſticks grooved hollow: let it be about three feet nine " inches long; and, that it may be the eaſier thruſt down to the " bottom of the corn in the ſack, its end is to be made taper to a " point, by a wooden plug that is fixed in, and ſtops the orifice. " About an hundred and fifty ſmall holes, of one eighth of an inch " diameter, are to be bored on all ſides of the ſtick, from its bottom, " to two feet ten inches of its length; but no nearer to the ſurface of " the corn, leſt too great a proportion of the air ſhould eſcape there. " By wreathing a pack-thread in a ſpiral ſcrew-like form round the " ſtick, the boreing of the holes may be the better regulated, ſo as " to have them about half an inch diſtant towards the bottom, but " gradually at wider diſtances ſo as to be an inch aſunder at the " upper part: by which means the lower part of the corn will " have its due proportion of freſh air. To the top of the ſtick let " there be fixed a leathern pipe ten inches long; which pipe is to be " diſtended by two yards of ſpiral wire coiled up within it. At the " upper part of the pipe is fixed a taper wooden fawcet, into which " the noſe of a common houſehold bellows is to be put, in order to " ventilate the corn.

" If corn, when firſt put into ſacks, be thus aired every other, or " third day, for ten or fifteen minutes, its damp ſweat, which would " hurt it, will, in a few weeks, be carried off to ſuch a degree, that " afterwards it will keep ſweet with very little airing, as has been " found by experience.

" By the ſame means many other kinds of ſeeds, as well as corn, " may be kept ſweet, either in ſacks or ſmall bins: but then in bins the

" the air-holes muſt be made only near the bottom of the canes, " becauſe the air muſt in that caſe all aſcend upward, ſince it " cannot go through the ſides of the bin, as it will through " ſacks."

Experiment on 75 cubic feet of new wheat, extremely moiſt, and which had already contracted a bad ſmell.

THE harveſt of 1745 was very rainy, and all the corn had grown in the ear. In the common granaries, it was always in a ſtate of fermentation, tho' laid but a foot deep, and turned every four or five days.

Seventy-five cubic feet of this grown corn, which ſmelled very ill, and was ſo moiſt as to wet the floor of the granary where it lay a few days, were put, in this condition, and without being dried, into one of our little granaries, with ſmall hopes of ſucceſs.

As the corn was very hot when put into the granary, it was ventilated three or four times the firſt week, and once a week during December and January: and as it had loſt great part of its bad ſmell, from that time till June it was ventilated but once a fortnight.

Then, perceiving, by the running of one's hand into the top of the heap, that it heated, we concluded it was going to be entirely corrupted; which determined us to empty the granary: but when we had taken out about a foot of the top, we were greatly ſurpriſed to find the reſt cool, with very little bad ſmell, and drier than that which was preſerved in the common granaries.

The reaſon why the top was the worſt, was, the moiſt vapours being always forced upwards in ventilation: and we apprehend that if, inſtead of emptying the granary, it had been ventilated oftener, the moiſture that was at the top might have been dried away.

This experiment teaches us one important thing, which is, that in this ſort of granary the top of the heap is moſt ſubject to heat; ſo that if the grain taken out of the vent-holes is in good condition, you may conclude the reſt to be ſtill better.

Where the corn is too moiſt for the granary, M. Duhamel propoſes drying it in a kiln, previous to its being put into the granary of preſervation. This agrees with a ſtory which Mr. Tull relates of a neighbour of his in Oxfordſhire, who acquired a large fortune by this practice. His method was, to dry his wheat on a hair-cloth,

in

in a malt-kiln, with no other fuel than clean wheat-ſtraw; never ſuffering it to have any ſtronger heat than that of the ſun. The longeſt time he let it remain in this heat, was twelve hours; and the ſhorteſt time, about four hours: the damper the wheat was, and the longer intended to be kept, the more drying it required: but how to diſtinguiſh the degree of dampneſs, and the number of hours proper for its continuance on the kiln, he ſaid, was an art impoſſible to be learnt by any other means than by practice. His ſpeculation, which put him upon this project, was, that it was only the ſuperfluous moiſture of the grain that cauſed its corruption, and made it liable to be eaten by the weevil. When dried, the bakers allowed it to work better than new wheat, and every grain would grow after it had been kept ſeven years. Mr. Tull adds, that the moſt ſecure way he knows of preſerving wheat, is by drying it.

Experiment on 90 cubic feet of fine wheat, which was preſerved without ventilation, after having been dried on a kiln.

THIS wheat, tho' very full of ſmut and duſt, was ſo well cleaned as to have no fault remaining but dampneſs. It was dried in a kiln, by which it loſt a little diſagreeable ſmell it had before; and when it was thought to be ſufficiently dried, it was laid up in one of our granaries of preſervation, which had bellows adapted to it: but there was no occaſion to uſe them.

It appears by this experiment, that wheat well cleaned and dried need not be ventilated.

Experiment on 75 cubic feet of ſmall wheat, mixed with ſmut, which had been dried on a kiln.

OUR different ſcreens clean'd the large wheat perfectly; but with all our care we could not free this ſmall wheat from ſmut, duſt, &c. of which much remained, and the kiln did not clear it from the bad ſmell it had contracted.

Frequent ventilation would undoubtedly have taken away that bad ſmell: but this experiment being to try the effect of the kiln only, we determined not to ventilate, unleſs there was great danger of the wheat's corrupting, which did not happen: but yet the bad ſmell increaſed ſo much, that we were obliged to kiln-dry it again after it

was

was taken out of the granary, and to ſcreen it ſeveral times, by which means it made tolerable good bread.

This experiment ſhews, firſt, how neceſſary it is to clean the corn well before it is put into the granary of preſervation, and that, in ſome caſes, both ventilation and kiln-drying are neceſſary: ſecondly, that corn which has contracted a bad ſmell, may be cleared of it by the kiln and wind-ſcreen.

Having found by the foregoing experiments, that good corn, well cleaned, and properly kiln-dried, may be preſerved without ventilation, and that good corn tolerably dry may be preſerved by ventilation only, we conclude that it muſt be moſt advantageous to join both methods, eſpecially for large magazines.

Experiment on 825 cubic feet of fine wheat lightly kiln-dried, and ventilated.

THIS wheat was of the year 1750, and conſequently but of a middling quality. After being well cleaned, and lightly kiln-dried, it was put in the granary of preſervation, about ſeven feet deep, which granary had bellows worked by a wind-mill.

This corn had a bad ſmell, which was not entirely diſſipated by the kiln, but it was quite cleared of it by ventilation. It was not only well preſerved thereby, but was ſo meliorated, and became of ſo good a quality, that the bakers preferred it to all other, and gave two pence a ſack more for it, than for the ſame wheat preſerved in the common way.

It is certainly moſt advantageous to unite both methods, not only becauſe they are moſt effectual in preſerving corn, when joined together, but alſo becauſe they are then leaſt troubleſome and expenſive: for to kiln-dry it ſufficiently to keep without ventilation, requires a large fire and long attendance; and to preſerve it without kiln-drying, will require very frequent ventilation; whereas, by joining the two methods, both are rendered very eaſy and leſs expenſive, and the ſucceſs is more certain.

In all theſe experiments, we have never ſuffered any thing by moth, or weevil, tho' the common granaries were greatly infeſted with them at the ſame time. This is a good prognoſtic: but we muſt not conclude from hence, that this method will abſolutely prevent the miſchief. It may be ſuppoſed, that the care we had taken, in theſe experiments, to clean the corn, had entirely freed it from them: and it may be objected that this great care cannot be taken in large ſtores, and that, if any ſhould get into the heap, they would be by ſo much the more dangerous, as they would remain longer undiſturbed. Theſe reflections determined us to make the following experiment.

Of the Moth *or* Worm.

THE moth lays its eggs on the corn, and thoſe eggs produce worms or caterpillars, which feed on the corn, and ſpin a ſilky web, which extends ſometimes to three or four inches deep, and entirely ſpoils all the grain within that depth, beſides communicating a bad ſmell to the whole maſs.

In the winter of 1746, we collected from our ordinary granaries, all the wormy cruſts thus formed, which were very thick, the moths having been very numerous the preceeding ſummer: theſe cruſts were broken and ſcreened, and what grain could be got from them, which undoubtedly was impregnated with the eggs of the moths, was put into one of our granaries of preſervation, which contained ſeventy-five cubic feet, and was ventilated from time to time all the winter.

About the end of May, if the vent-holes at top were opened, a vaſt number of moths flew out; which ſhewed they did not like their ſituation.

In June 1747, the granary was emptied: the moths and worms were all periſhed, and there remained only a thin cruſt, about one eighth of an inch thick, on the top of the corn, which had ſo far loſt the bad ſmell it had when put into the granary, that it ſold for the current market-price.

Dr. Hales obſerves, that kiln-drying often makes corn grind unkindly; and therefore propoſes the following method of drying ſmutty corn, after it has been waſhed; cold air not hurting it, as kiln-drying is found to do. "That I might be well aſſured, ſays "he, of the good effect of thus drying ſmutty corn, having pro-"cured a quantity of very ſmutty wheat, which weighed ſeven "pounds and fifteen ounces, on the twenty-ſixth of May, at five in "the morning, it was waſhed clean in four ſeveral waters, which "was done in a few minutes, and was then laid to drain in an oat-"ſieve, till half an hour after five, when it had increaſed in weight, "by wetting, ten ounces, beſides the moiſture that was equal to the

"weight

" weight of the ſmut-balls and ſmut that was waſhed from the
" wheat. It waſted but two ounces and an half, by the firſt two
" hours ventilation; two ounces and five drachms in the ſecond two
" hours, *viz.* from eight to ten; in the next ſix hours, *viz.* from
" ten to four in the afternoon, it waſted at the rate of four ounces
" every two hours; from four to ſix, two ounces and an half; and
" from ſix to eight, one ounce and an half: in all, about twenty
" ounces; ſome allowance being made for what corn was waſted by
" handling and biting ſome of it from time to time. It was venti-
" lated in theſe fourteen hours with about forty thouſand gallons of
" air, which paſſed upwards through it, and made it ſufficiently
" hard and dry, ſo as to be fit for grinding: it was well coloured,
" and handled well; and, from ſtinking, as ſmutty wheat does, it
" became much ſweeter. The viſible dewy moiſture was blown off
" in three hours; but it continued damp and cold to the feeling till
" two o'clock, when ſome little duſt began to fly off it.

" And whereas it waſted off much leſs moiſture during the firſt
" four hours ventilation, when it ought to have waſted the moſt, on
" account of its being then wetteſt, this was owing to the foggy ha-
" zineſs of the morning: which as it went off, and broke out into
" fine warm ſun-ſhine, towards ten o'clock, ſo the air being there-
" by become dry, it imbibed moiſture more ſtrongly from the corn:
" and that this was the true cauſe of the difference, is farther con-
" firmed by a like experiment which I had before made on a gallon
" of wheat, April the firſt, there being then a very dry north-eaſt
" wind.

" It will be adviſable to begin to ventilate corn as ſoon as poſſible
" after waſhing it, that the moiſture may have the leſs time to ſoak
" in: for the leſs the moiſture ſoaks in, ſo much the ſooner the corn
" will dry.

" If the moiſture is ſo eaſily carried off from wet wheat, by ven-
" tilation, this method will doubtleſs much improve what is called
" cold wheat, *viz.* ſuch as is grown, and has been houſed in a cold
" wet ſeaſon; and will therefore ſoon carry off the moiſt vapours
" which ariſe from corn, and cauſe it to heat and grow muſty."

Of the Weevil.

THE weevil is of the beetle kind. It devours a great quantity of corn, as well old as new, but does not communicate any bad ſmell to it, as the moth does. It will endure the heat neceſſary for kiln-drying, and is numbed, but not deſtroyed, by intenſe cold. The weevils are generally found collected in heaps, which feel very warm. This warmth is probably neceſſary for hatching their eggs; and if ſo, they will not be in a condition to propagate their ſpecies in our granaries. No ſmoke will deſtroy them, but that of ſulphur; and that gives a bad ſmell to the corn.

In May 1751, we put ſome weevils into one of our granaries: and when it was opened in Auguſt 1752, we found none.

M. Duhamel, in the fifth volume of his Treatiſe on Agriculture, gives the following farther experiments on the preſervation of corn.

Experiments made at Denainvilliers, *on the preſervation of corn.*

THE wheat of 1754, being of an excellent quality, and that harveſt having been very fine and dry, my corn, after being kept all the winter in a common granary, was divided into two parts, one of which was depoſited in one of our granaries of preſervation, without being ſtove-dried; concluding that, as it was ſo well conditioned, the renewing of the air with the bellows, would be ſufficient to preſerve it. In effect, this corn remained always cool and in good order.

The other part was ſtove-dried and laid up in another granary of preſervation; where, as it did not heat at all, I am apt to think it would have kept without the aſſiſtance of the bellows: but this is only a conjecture; for it was ventilated nearly as much as the other.

In my treatiſe on the preſervation of corn, I mentioned my having kept wheat ſeven years, without its being attacked by any inſect: but indeed it had no weevils in it, when it was put into the granary, which was always kept ſo cloſely ſhut, that there was not the leaſt room for that inſect to get in any where. I likewiſe ſaid in the ſame work, that after having laid up in a granary of preſervation, wheat which had been ſtove-dried, and put ſome weevils in among it, not one of them was to be found when that granary was emptied eighteen months or two years after.

The caſe was not the ſame this year. I had put ſome weevils into the granary in which I laid up wheat, not ſtove-dried, of the harveſt of 1754.

In May 1756, wanting to lay this wheat, which had not been ſtove-

ſtove-dried, upon ſome other which had been dried, in order to empty one of my granaries for wheat of the harveſt of 1755, I ordered it to be ſifted through a wire ſcreen, and found, while that was doing, nearly the ſame quantity of weevils that I had put into it. I have reaſon to think they had not multiplied; becauſe it is well known that this inſect heats prodigiouſly the corn it gets among, either in the granary or the barn; and the corn I am ſpeaking of was ſo cool, that a country fellow whom I employed for this work, could hardly remain bare-footed amongſt it. When the time ſhall come round for emptying this granary, in which there now is wheat of the harveſt of 1754, part ſtove-dried, and part not dried, I ſhall take care to examine whether the weevils have increaſed. Hitherto, this corn has always been very cool.

In May 1756, I ſtove-dried corn of the harveſt of 1755, in order to put it in the ſame granary of preſervation in which I had kept that of 1754 not ſtove-dried.

This corn of the harveſt of 1755, having been reaped in rainy weather, continued extremely damp: and tho' care had been taken to turn it every week, from the time of its being removed out of the barn, it had contracted a very bad ſmell, pretty much like that of pigeon's dung. I therefore determined to ſtove-dry this corn for 48 hours. A putrid ſmell iſſued from it. After this corn had been thus ſtove-dried, I had it ſifted immediately, to cool it, and cleanſe it from that ſmall duſt which falls off dry corn. After this, I put it into a granary of preſervation, and ordered it to be ventilated more carefully than the old corn.

This wheat has never heated, but has always remained perfectly cool, and has quite loſt its bad ſmell.

We ſee by this experiment, an inſtance of the good effect of the ſtove, ſince it rendered capable of being preſerved, wheat which could not have been kept in the common way. The ſtove likewiſe deſtroyed the bad ſmell which would have leſſened the price of this corn very conſiderably. At the ſame time, a parcel of wheat of the ſame crop, which had begun to grow, and had contracted a very bad taſte, was ſtove-dried with ſtill more care. It dried perfectly, was in excellent condition for keeping, and had no bad ſmell: but if it was chewed, it had a diſagreeable taſte, and the paſte made of this grown corn, which ſeemed to have been ſo well recovered, did not riſe in the kneading-trough, and the bread made of it was very heavy and of a diſagreeable taſte.

As

As I had not yet tried any experiment on the preſervation of barley and oats, I filled two ſmall granaries with theſe grains, without ſtove-drying them.

The oats remained cool, and kept extremely well: but the barley emitted ſo great a quantity of moiſture, that the boards at the bottom of the granary were quite warped by it: and this grain heated to ſuch a degree, that the bellows worked by hand could not cool it, tho' conſtantly plied for eighteen months together. When this granary was emptied, we found the boards covered with a ſtinking glutinous moiſture, which had communicated itſelf to the whole maſs of this corn. I then judged that all of it was ſpoiled, eſpecially as the heat had ſpread to every part of the granary, and the outſide of the corn was rotted all over for near two inches deep, and ſtuck to the ſides and bottom of the granary. I likewiſe perceived that a prodigious number of weevils had bred in this granary. Notwithſtanding all this, I reſolved to try whether I could make any thing of this corn. To this end, I ordered it to be put into my ſtove; after which I ſifted and winnowed it, to clear it of the grains that had no flour in them, which were pretty numerous. This operation leſſened the maſs by about one twelfth: but the good corn was very dry, and had no bad ſmell. I have put it back into the ſame granary, to ſee whether it will be poſſible to keep it after this ſtove-drying.

Experiments on the Preſervation of Corn, by Dom Edward Provenchere, *Procurator of the Carthuſians of Liget, near Loches.*

IN 1755, Dom Edward intending to make ſome experiments on the preſervation of corn, choſe for that purpoſe a large caſk, at one end of which he put a double-barred grate, and over that a canvas. This caſk was filled with wheat of the harveſt of 1754, not ſtove-dried, and contained 1080 pound weight. He then fixed to it a pair of middle-ſiz'd bellows, ſo ſituated that they might eaſily be worked. Nearly in the center of this corn, he put as many weevils as weighed ſix drachms: which is pretty conſiderable for that quantity of corn.

The bellows were blown an hour every week. In the beginning of September, when that operation had been neglected for ſome time, the corn began to heat: but it was ſoon cooled again by uſing the bellows. The 15th of October, on taking the corn out of this caſk, in which it had kept perfectly well, not above twenty weevils were found

found in it. Dom Edward ſays he ſaw that inſect come out of the caſk every time the bellows were blown. He perceived in many places ſeveral grains of corn faſtened together by threads, which had been certainly formed by moths that were in this corn which had not been ſtove-dried, and, not dying immediately, had had time to ſpin their web. The experiments, adds M. Duhamel, which I have related in my treatiſe on the preſervation of corn, have, I believe, proved ſufficiently, that this inſect cannot breed in granaries made after the manner there directed. I wiſh I had as ſtrong proofs of their deſtroying the weevil.

Dom Edward filled another caſk with 900 weight of barley, not ſtove-dried, and put into it ſix drachms of weevils. Tho' care was taken to ventilate this caſk, as much as the former which was filled with wheat, that is to ſay, during an hour every week, yet this corn heated prodigiouſly: the bellows could not cool it, and the weevils multiplied in it exceedingly. This is the very thing that happened to me in my larger experiment on the ſame kind of grain, and which I mentioned in the preceding article. Barley probably contains a great deal of moiſture: and the queſtion is whether ſtove-drying can be able to preſerve it. This increaſe of the weevils ſeems to prove what I ſaid before, that this inſect cannot multiply in corn that retains a proper degree of coolneſs.

Experiment on the preſervation of corn, made at the royal abbey of St. Stephen of Caen, by Dom de Sainte Affrique, *prior of that abbey.*

DOM de Sainte Affrique kept 1200 buſhels * of wheat in a granary like thoſe deſcribed in our treatiſe on the preſervation of corn.

This granary was 12 feet wide, 13 feet long, and 6 feet deep; which forms a parallelipepede of 936 cubic feet.

The wheat that was laid up in this granary of preſervation, had not been ſtove dried; but had been kept all the winter in a common granary. It was cooled from time to time by two bellows, which two men worked by means of a lever.

Tho' the place in which this granary of preſervation ſtood, was neither ſo dry nor ſo airy as might have been wiſhed, the corn kept perfectly well in it.

Fully ſatisfied with this trial, Dom de Sainte Affrique intends to have large granaries built, with a ſtove to dry the corn, and a mill to

* The Caen buſhel weighs 45 pounds.

work

work the bellows. If he puts this in execution, he will render an important ſervice, not only to his abbey, but alſo to the public: becauſe he will thereby be enabled to apply to a larger object than has hitherto fallen in our way, principles of which we think we have demonſtrated the certainty and the utility, and which we could wiſh to ſee adopted by greater numbers of people.

Experiments on the preſervation of corn, by M. Vandusfel.

IN the beginning of September 1754, M. Vandusfel filled one of M. Duhamel's granaries of preſervation, ſeven feet ſquare and ſix feet deep, with good wheat, not dried. It heated a little at the end of eight days; but two men, with a ſmall double ventilator, cooled it in two hours time. It began to heat again about a week after, when he repeated the ſame operation, which cooled it preſently; and on the 20th of October it was quite cool, tho' it had not been ventilated for fifteen days.

M. Vandusfel, in a letter to M. Duhamel, dated the 14th of October, 1756, tells him that this corn ſtill continued in the ſame good condition. He adds, that in Auguſt 1756, he filled a ſmall granary with dried corn, which had kept perfectly well to the time of his writing, without being ventilated at all. Corn of the years 1754 and 1755, not dried, but only ventilated, had likewiſe kept as well as could be wiſhed: and a parcel of corn which he dried and put into caſks, remained ſix months in them, without being ventilated, and was perfectly ſound at the end of that time. However, he obſerves, that both dried and undried corn, if ſuffered to remain a month without being ventilated, contracts a diſagreeable ſmell, which is perceived when the bellows firſt begin to work, but is entirely diſſipated in a few minutes. This ſmell is not a ſymptom of corruption or decay, but only a ſtrong ſmell of corn, ſuch as is always perceived on entering into a granary that has been ſhut for any length of time.

CHAP.

CHAP. V.

OBSERVATIONS *on the* WEATHER, *made during the years* 1755 *and* 1756, *at Denainvilliers, near Petiviers, in the Province of Gatinois, by* M. DUHAMEL.

SECT. I.

Observations made during the year 1755.

M. Duhamel has given in each of his volumes, an abstract of the state of the weather, and of the effect it had upon the health of animals and the growth of vegetables. The whole series of his observations on this subject is the less necessary, as the state of the weather is generally mentioned in the account of the experiments. We shall therefore give only his observations during the two last years, as a model for others to follow.

JANUARY.

The weather was very cold all this month: M. de Reaumur's thermometer was almost continually below the freezing point: on the 6th at noon, it fell to 10 degrees below freezing; and on the 8th, in the evening, to 11 degrees.*

The greatest variations of the barometer were from 27 to 28 inches, and one twelfth.†

But little rain fell this month. The continual frosts prevented cultivating the earth.

FEBRUARY.

The cold continued all this month. On the 4th, in the morning, the thermometer fell to 8 degrees and an half below the freezing point: consequently no ground could be plowed or hoed.

The barometer was always very low: on the 7th, it fell to 26 inches and an half: some rain fell that day, and the wind was very violent.

* Those who would compare M. de Reaumur's scale with that of Farenheit, which is more generally used in this country, may consult Dr. Martin's Essay on the Construction and Gradation of Thermometers.

† The English inch is to the French inch, as 1000 are to 1068.

March.

Though the thermometer was but 1 degree below the freezing point, on the 3d, in the morning, the air continued ſharp. The barometer fell again to 26 inches and ſeven twelfths; and on the 6th and 7th, to 26 inches and ten twelfths.

Tho' ſome rain fell from time to time, yet the wind and ſun ſoon dried the ſurface of the earth. However, our farmers went hard to work, to get their grounds ready for the ſpring corn. This labour had been greatly retarded: but before the end of the month, they began to ſow oats, which came up very ſoon.

April.

The temperature of the air changed ſuddenly, and became as hot as in ſummer. The thermometer was ſeveral times 15 degrees above the freezing point, in the morning: and on the 15th and 20th, at noon, it was 26 degrees above it.

This warmth put in motion the ſap, which had remained till then in a kind of inaction. By the 15th, the trees were as full of leaves as they generally are in the middle of May: and towards the end of the month, the vine had leaves as broad as one's hand.

The corn was very green: but the oats that were ſown after March, being in too dry a ground, did not riſe.

The ſame warmth which quickened the vegetation of plants, gave birth to a prodigious quantity of caterpillars of all kinds. The fields were likewiſe full of gnats and bugs; and, in general, all ſorts of inſects appeared in great quantities. Some eat up the leaves of the trees, and others attacked the bloſſoms of pears and cherries; ſo that, in a ſhort time, both woods and orchards were ſtripped of their leaves and fruit.

Towards the end of the month, ſome ſmall ſhowers fell, which were of great ſervice to make the oats riſe. The 29th and 30th, there was a hoar-froſt: but as the ſun did not appear in the morning, it did no damage.

Some ſhowers of hail fell in our neighbourhood, and damaged the young buds. The apricot and peach trees knit their fruit perfectly well, and were the only trees that ſeemed to promiſe plenty.

Notwithſtanding the rains which I ſaid were of ſervice to the oats, the

the earth remained dry and cracked in its ſurface, as it generally is in July and Auguſt: but luckily it was moiſt beneath that upper cruſt. The barometer was always high enough, and roſe on the 15th to 28 inches.

May.

The 3d, the ſky was clouded all the day: diſtant thunder was heard; but no rain fell, though greatly wanted for the ſpring corn.

The 5th, it froze pretty hard: the vineyards which lay low were greatly damaged: thoſe upon high grounds ſuffered little. The 8th, it hailed: the 18th, we had neither thunder nor rain; but at Etampes, which is 21 miles from Petiviers, there was a great ſtorm, which chill'd the air ſo much, that people were obliged to make fires.

The froſts which happened from time to time during all this month, were hard enough to deſtroy all the vines: but, as I obſerved before, thoſe upon the high grounds were but little hurt; which may be imputed to the great forwardneſs they were in: for, in general, the buds of the vine do not begin to open till about the 10th of May; whereas their leaves were this year, at that time, as broad as one's hand. The ſhelter which theſe leaves afforded, added to the more than common hardneſs of the buds, was probably what prevented the froſt from doing much hurt; eſpecially as numbers of buds were frozen at the point.

Notwithſtanding the froſts we have been ſpeaking of, the caterpillars and other inſects continued to do great miſchief; inſomuch that the pear-trees, and almoſt all others, were left as bare as in the middle of winter: and afterwards thoſe inſects, unable to ſubſiſt any longer there, fell upon the peach, cherry, and other trees, which they very rarely attack.

Tho' the earth was very dry all this month, the ſky having been frequently clouded, the oats which had been benefited by the rains in the preceding month, continued to riſe, and the others increaſed in ſtrength.

Great numbers of children were attacked with violent hooping-coughs, of which ſeveral died. Some grown perſons too were attacked with the ſame diſorder.

June.

Towards the end of laſt month, the horizon was covered from eaſt to ſouth with thick clouds, the fore-runners of a ſtorm of hail, thunder, and rain, which did a great deal of miſchief in the Limoſin and Berry. From that time, the ſame part of the ſky remained continually covered with heavy clouds, which made us hope we ſhould have rain. In effect, it did rain pretty often in the Limoſin; but we had not the ſame advantage. It is commonly obſerved, that in dry years, it rains oftener than elſewhere, in thoſe places where great ſhowers have fallen ſome time before. Perhaps the reaſon may be, that the exhalations which riſe from the earth in thoſe places, meeting thoſe which form the clouds, make them fall down in ſhowers of rain.

The 4th, we had a ſmall ſhower of pretty large hail, and ſome claps of thunder were heard. One of our elms, the trunk of which might be 14 or 15 inches diameter, was broken in two by the thunder, and two of its greateſt branches were carried away to a conſiderable diſtance.

The 12th, the ſainfoin, which had remained very low, was houſed. The corn, tho' not tall, made a good appearance; and the vines were in full bloſſom. The ſmall kinds of grain were in great want of water. The haſty rains which fell from time to time did a great deal of good in ſeveral places: but, in general, they were not plentiful enough to moiſten the earth thoroughly, and were only juſt ſufficient to keep the oats from periſhing. Accordingly, the ponds in moſt of the villages near us were dry.

The thermometer roſe ſeveral times this month to 27, 28, and 29 degrees above freezing: and the air may be ſaid to have been hot and dry during all this month.

Towards the middle of the month, part of the caterpillars being metamorphoſed, a prodigious quantity of all ſorts of butterflies appeared.

The 18th, the orange trees were in full bloom. By the 25th, we had early apricots upon the table. Amel, or ſtarch-corn was cut the 28th, and the rye drew towards a ſtate of maturity.

July.

JULY.

The 12th, at noon, the thermometer marked 25 degrees. The 18th, walnut-kernels, and common apricots were brought to table.

The drought continued till towards the end of this month. The corn began to be reaped the 20th: but it was very low, and a great deal of it was parch'd and ſhrivel'd. Rain was greatly wanted; eſpecially for the oats. It began to fall plentifully about the 18th; and as the corn was then ripe enough to begin to cut it, our farmers ſoon complained that they had then too much wet. In effect, the rains which fell after that time did great hurt.

By the end of the month, the grapes for making verjuice were very fine in the vineyards; and the early grapes againſt walls or eſpaliers had already began to turn. By the 31ſt, partridges were very fine and fit for killing.

AUGUST.

The rains continuing in the beginning of this month, and at the time when the harveſt was above half over, the corn that was cut, ſprouted in the field, and was abſolutely loſt. That which ſtill remained ſtanding began alſo to ſprout, when, at laſt, the rains ceaſed. This laſt may ſtill turn to ſome account, tho' it is very white and full of moiſture. Happily, but little rain fell during the reſt of this month, tho' the ſky was continually clouded, and the air very cold. All the corn was got in by the 15th.

The moiſture which was ſo prejudicial to the wheat, was of ſingular ſervice to the oats, which were cut as they ripened. Tho' the coolneſs of the air checked the progreſs of the vine, the grapes began nevertheleſs to turn. The wet rotted great quantities of apricots. As to peaches, there was plenty of them, but they were pale, and had no flavour.

Notwithſtanding the rains in the beginning of this month, we were over-run with caterpillars, which, after ſtripping the trees, fell upon the vines that were near them.

SEPTEMBER.

This month was, in general, cold and dry. The vintage was begun about the 15th, in very fine weather, and ended about the

21ſt,

21ſt, after ſome days of cold rain. The grapes that were gathered firſt, fermented very ſoon: thoſe that were gathered later, were ſome days before they began to grow warm. The wines were made ſo expeditiouſly, that they were all tunned by the beginning of October.

Towards the 25th, ſaffron began to be gathered. If the crop of this flower had been greater, much of it would have been loſt, becauſe the ſeaſon for gathering it happened juſt at the time of the vintage.

October.

The ſky was over-caſt almoſt all this month, tho' we had but little rain: conſequently the earth was well diſpoſed for plowing and ſowing. The farmers took advantage of it; and moſt of their lands were ſown by the 10th. The reſt of this month was employed in giving the winter fallow.

The late peaches did not ripen thoroughly.

November.

It rained almoſt every day this month, and the wind was often very high. So much rain fell, that ponds were formed in ſeveral ſtiff grounds, where the farmers were not able to continue their tillage. The river Eſſonne was ſwelled conſiderably.

The corn came up very finely; and, notwithſtanding the rains, preſerved its verdure tolerably well in grounds not ſtiff enough to retain the water.

The firſt of this month, a day remarkable for the earthquakes that were felt in Portugal, Spain, France, and England, a very cold north wind blew. The thermometer was 2 degrees and an half above the freezing point; and on the 2d, 1 degree. The barometer was at 27 inches and eleven twelfths; the 2d, at 27 inches and twenty-one twenty-fourths; the 3d, at 27 inches and three fourths; the 4th, at 27 inches and five twelfths; and the 5th, at 27 inches. That ſame day, it thundered, and we had a ſhower of hail with a ſtrong wind. The quickſilver was very low all this month.

I am the more particular in my account of the riſe of the quickſilver, becauſe of the relation it may poſſibly have with the earthquakes, which were very little felt in our province, where, however, ſome

ſome perſons, who could not be informed of the earthquake at Liſbon, aſſerted that they perceived ſome ſlight ſhocks.

December.

The ſky was cloudy almoſt all this month, and it rained almoſt every day. The air was mild enough; there being only a hoar-froſt the 22d and 23d.

The continual rains rendered the roads impaſſable. The corn-lands were full of ſtanding waters. However, the corn kept up where the ſoil was not too ſtiff; but it ſuffered in black and clayey grounds. As it was impoſſible to plow, the farmer's works were greatly retarded.

General idea of the temperature of the air, and of the productions of the earth, during the year 1755.

THE winter was very long and ſevere; for the froſts ſtill continued in January and February, and the thermometer fell to 11 degrees in the month of January. But little rain fell during theſe two months, nor in March or April. As the air continued very ſharp, the ſap of plants remained without motion: but the month of April being ſo warm that the thermometer roſe to 26 degrees, above freezing, vegetation made a great progreſs: trees bloſſomed and were covered with leaves; and by the end of that month the vines had leaves as broad as one's hand. In the beginning of May, the air grew ſo cold on a ſudden, that there was reaſon to fear for all fruit-trees, and particularly the vine: and if no great harm did enſue, it muſt be aſcribed to the drought, which, as well as the chillineſs of the air, ſtill continued during all June, and till the middle of July. From that time, we had almoſt continual rains, which were as prejudicial to the wheat, as they were favourable to the ſpring corn. Theſe rains hardly ceaſed at all during the whole month of Auguſt. September and October were very dry, and the air ſtill cold: and laſtly, a great deal of rain fell during the months of November and December, which paſſed almoſt without any froſt.

Wheat.

The winter, the ſpring, and part of the ſummer having been very dry, the ſtraw of the wheat did not grow tall, but the ears were fine enough,

enough, and the grain was of a good quality, tho' ſomewhat ſmall: However, a great deal was parched and ſhrivelled on light ſoils.

The harveſt was begun in very fine weather: but before it was finiſhed, ſuch continual rains fell, that all the corn that was cut, ſprouted, and was entirely loſt. What was ſtanding, fared better: but the reſult was, that the corn of this harveſt was of three very different qualities. That which was houſed before the rains came on, is very good: that which was down when the rains fell, has no flour in it, and is hardly fit even for poultry: and that which was ſtanding at the time of the rains, is full of moiſture, yields but little flour, and will be very difficult to keep.

Old wheat has been ſold for 14 or 15 livres the ſack, weighing 240 pounds; and the new has fetched from 10 to 13, according to its degree of dryneſs.

Oats.

We have ſeen by the foregoing account of the months of this year, that the tillage for ſpring corn was greatly retarded, and that the oats which were ſown firſt were benefited by ſome ſhowers of rain which made them riſe: thoſe which were ſown late, were a long time before they appeared; and as they roſe at laſt only by the help of ſudden ſhowers, ſome were much forwarder than others.

The drought, which was almoſt continual till the middle of Auguſt, gave room to fear leſt the harveſt of this grain ſhould fail entirely: and indeed, notwithſtanding thoſe flying ſhowers, the crop of oats was but indifferent both in quantity and quality. Thoſe of our province are white and light, and ſell for only five livres a ſack, whilſt old oats ſell for ſix.

Barley.

Almoſt all the barley in our parts was burnt: but this accident can hardly have been general, ſince the price of this grain is nearly the ſame as that of oats.

Rye.

We raiſe but little rye in our province: each farmer ſows juſt as much as will yield him ſtraw to make what bands he wants for tying up his ſheaves, and other ſuch like uſes. This grain fared nearly as the wheat did.

Leguminous Plants.

There was great plenty of garden beans this year: but the crop of peas, lentils, and kidney-beans, was but middling.

Pot-Herbs.

Turneps of all kinds abounded. Some, of which I had the feed from Scotland, were 29 inches in circumference. Cabbages were very plenty, but their hearts were fmall. The beet-roots, carrots, and fcorzoneras which we cultivated with the horfe-hoe, grew to a furprizing bignefs; far beyond any in the beft kitchen gardens. Artichoaks yielded plenty of fine heads in the fpring, and again in autumn, fo that we had them till December.

Hay.

As the fainfoin bloffomed in the dry feafons, it remained: but its quality was very good.

The meadows in general yielded but little hay; and even that, being wet in moft places after it was cut down, was fcarcely good for any thing. Our meadows, which are extremely well cultivated, were as well covered as in the beft of years; and as we got our hay in dry, its quality was very good.

Hemp.

Hemp did not grow high this year: but, that excepted, it was very good. What was fown in grounds bordering upon water, fucceeded much better than any other.

Wine.

The vines that were nipped by the frofts in the fpring, yielded but little wine, and that fharp and flat. Other vines yielded the value of a good half year. The grapes fermented as foon as they were put into the tub, and as the froth fubfided very quickly after, the wines were made in a few days. Moft of thefe wines have colour enough; but, in general, the old wines deferve the preference.

Fruit.

The caterpillars having devoured all the verdure of the apple, pear, and plum trees, we had none of thofe fruits this year. Our oak trees ſhared the ſame fate. We had few cherries, but quantities of apricots and peaches. The beech trees, and the cheſnut and walnut trees in our neighbourhood, yielded likewiſe but little fruit: but in ſome other places there was abundance of nuts.

NURSERIES and PLANTATIONS.

The drought of the ſpring and ſummer was by no means favourable to nurſeries and newly planted trees. The caterpillars which devoured the tender ſhoots, did them a great deal of harm.

SAFFRON.

Tho' the crop of ſaffron was very ſcanty, it did not ſell for above twenty livres a pound. I have been aſſured that the commiſſioners of Petiviers brought the ſaffron of the Gatinois into diſrepute, by wetting it, in order to increaſe its weight; which made it ferment.

INSECTS.

There was a prodigious quantity of all ſorts of inſects, and eſpecially caterpillars, which devoured the verdure, and eat up the tender ſhoots of plants, not yet ſtrong enough to reſiſt them. They attacked moſt kinds of fruit, and even fell upon trees which they generally ſpare, ſuch as the vine and the peach tree. I obſerved that they eat the violet peach rather than any other, and that even the leaves of that tree did not eſcape them. I muſt however except the cabbage caterpillar, which did no miſchief this year. There were but few gnats, and very few cantharides.

DISTEMPERS.

There were no epidemical or contagious diſtempers in the courſe of this year.

CATTLE.

Neither ſheep, cows, nor horſes, were attacked with any contagious diſtemper. The ſcarcity of fodder laſt year, made butcher's meat, and particularly veal, very dear: butter too kept up at a higher price than uſual.

GAME.

We had plenty of patridges and hares; but few quails and larks. Laſt year's ſnow had deſtroyed prodigious quantities of them.

BEES.

Bees.

The bees could lay in but a ſmall ſtock of proviſions laſt year, on account of the ſcarcity of flowers, occaſioned by the drought of the ſeaſon. Three fourths of our hives periſhed with hunger during the winter, and we had very few ſwarms.

Height of the Water.

All our high ſprings became dry, and remained ſo, notwithſtanding the rains in November and December: but our ſprings in low grounds continued to run plentifully.

SECT. II.

Obſervations on the Year 1756.

January.

THIS month was mild and wet: it rained almoſt every day: we had only ſome hoar-froſts, and the thermometer was never more than three degrees and a half below the freezing point. The earth was ſo wet, that no ground could be tilled, nor could any carriage go in the fields. The legs of the horſes of our ſtage waggons, by being always in the water, ſwelled. The ſkin peel'd off afterwards with the hair, and no bad conſequence enſued.

The quickſilver of the barometer was in continual motion: its variation extended from 27, to 28 inches and a half.

On the 13th, at night, we had a furious blaſt of wind, which happily laſted but a quarter of an hour.

February.

This month may be ſaid to have been a mild one, tho' there was a hoar-froſt almoſt every morning. It may likewiſe be ſaid to have wet, becauſe, though we had no heavy ſhowers, yet the ſky was almoſt conſtantly clouded, and ſmall miſling rains fell very frequently.

The barometer varied greatly and ſuddenly during all this month. It roſe to above 28 inches and one-ſixth, and fell below 26 inches and a half.

The 18th in the morning, on which day ſome ſhocks of an earthquake were felt at Paris, and in other places, the thermometer being at three degrees, towards ſix o'clock in the evening of the ſame day, the wind, which had begun to riſe at noon, was exceſſively violent, and the quickſilver in the barometer was fallen below twenty-ſix inches and a half. On the 20th, it roſe to 28 inches and one-ſixth. Theſe violent ſhocks in the atmoſphere had probably ſome connection with the earthquake: for it was obſerved that the riſe of the quickſilver had no ſort of relation to the rain, the wind, or fair weather. During this month, the ground was plowed for ſpring corn; and towards the end of it, oats began to be ſown.

MARCH.

Slight froſts were very frequent during this month; and the wind, which was almoſt always pretty violent and cold, rendered the air very diſagreeable.

The barometer was again ſubject to great variations. It roſe to 28 inches and one-twelfth; and fell to 26 inches and ten-twelfths.

Tho' the ſky was very often clouded, we had ſo little rain, that this month may be ſaid to have been a dry one. However, the oats that were ſown in ground which had been well moiſtened, roſe well.

APRIL.

The wind continued cold and diſagreeable, and the ſky frequently clouded: yet we had but little rain; and the earth was very dry. Some oats were ſown again this month.

The farmers were buſied with their fallow grounds, and thoſe who had vines gave them the firſt ſpring dreſſing.

Caterpillars appeared in great abundance: but the cold rains and the ſharpneſs of the air not agreeing with them, they did the leſs damage to our trees and plants.

MAY.

We had ſome froſts, eſpecially on the 2d and 3d of this month, ſo hard as to hurt our vineyards. Some ſuffered more than others, according to their ſituation and circumſtances. In places where flying ſhowers of hail and rain had fallen, the vines ſuffered greatly: where there had been plentiful rains, they were leſs hurt; and where they had had no rain at all, they were but very little damaged. The vine-dreſſers took advantage of the rainy weather to ſet up their vine props.

The

The caterpillars remained on the trees where they were hatched. There were ſuch prodigious quantities of them, that the oak trees in the foreſt of Orleans and other woods where they had not been deſtroyed, were as bare as in the middle of winter. However, they ſuffered greatly from the ſharpneſs of the weather, and eſpecially the common ſorts, which are thoſe that do the greateſt hurt, becauſe they eat the buds which ſhould form the next year's ſhoots. Theſe common caterpillars were ſo weak and flabby, that they bent and hung down quite motionleſs when they were taken up betwixt one's fingers: ſo that they did but little hurt, eſpecially where care had been taken to deſtroy them, and moſt of them died within this month.

The ſpring corn that was ſown in April, did not riſe in dry grounds: but the rain on the 25th, gave hopes of its coming up; and it was thought that this rain would be equally ſerviceable to the wheat, which began to grow red: but that grain wanted warmth as well as moiſture.

At the end of the month, the ſainfoin was in bloſſom, but greatly ſtinted in its growth.

June.

Tho' the earth was always moiſt during this month, the corn did not tiller, nor did it ſpindle without difficulty, by reaſon of the coldneſs of the air. Its blades ruſted, and the plants remained greatly ſtinted. The ſainfoin which was cut towards the end of the month, was likewiſe very ſhort. Weeds, particularly blue bottles and poppies, got the better of the wheat. The ſpring corn was very fine.

The cold and wet killed the caterpillars in great numbers, and towards the end of this month all of them had diſappeared.

July.

This month was ſo wet, that the roads were as impaſſable as in the depth of winter: the air was ſo cold that people cloathed themſelves as in winter, and were obliged even to make fires. However, the vines bloſſomed; but ſo ſlowly, that many were not out of bloom by the 15th, which gave room to fear that the vintage would be very late. On the 10th, the vines began to be tied up to their props.

At the ſame time the rye began to turn yellow, and a few warm days would have made it fit to cut: but the continual rains retarded the harveſt of that grain till the end of the month.

The wheat was very ſhort, and full of weeds, particularly poppies, blue-bottles, and fox-tails. As the ſeed of this laſt cannot be ſeparated from the wheat, it leſſens its value conſiderably, becauſe it gives the bread that is made of it, a bitter taſte and a purpliſh colour.

The oats were very fine, eſpecially where the ſoil was light. Barley and peas were alſo very fine: the grapes burſt, eſpecially thoſe which grew on ſtiff lands.

An epidemical diſtemper attacked the poultry: this was the pip and cancers in the throat. The former was cured by cutting the tongue; and for the latter, a finger was thruſt into their gullet, which was rubbed with ſalt, and their throat was afterwards waſhed with vinegar. Theſe fowls voided a great deal of ſlimy matter, and ſeveral of them recovered: but as young chickens could not be treated in this manner, many of them died.

AUGUST.

As we obſerved in the account of laſt month, the rye harveſt did not begin till the end of July: conſequently our farmers were buſied with that work in the beginning of Auguſt. To the rye, ſucceeded the wheat harveſt, which was begun and finiſhed without interruption. The ſky ſtill continuing cloudy, and threatening rain, people were in ſuch a hurry to houſe their corn, that they did not give the weeds, which the ſheaves were full of, time to dry. The conſequence was, that the corn piled up in barns, heated to that degree, that many were obliged to bring their ſheaves out to air them.

Luckily, notwithſtanding the uncertainty of the weather, which ſeemed every day to threaten rain, we had but little wet. The wind continued north, and very ſharp.

As the wheat was low and thin, part of it was mowed, and ſo great a quantity of weeds was gathered up with it, that ſome farmers who took the pains to ſeparate them very carefully, found that they had two thirds more weeds than they had wheat.

After harveſt, the new ſeed-corn, which was greatly inferior to the old, was worth from 22 to 24 livres the *ſeptier*, which weighs 240 pounds; and the old 20. The ſame meaſure of oats ſold for 5

livres

livres 10 ſols, or 6 livres. From 30 to 40 ſheaves were requiſite to make a *mine* of 80 pound weight.

The grapes did not begin to turn till the end of this month, and ſome ſorts of them were greatly hurt by their burſting.

SEPTEMBER.

The air was cold during all this month, which was rather wet than dry. The rains did great injury to the grapes, which, in ſeveral places, rotted or dropt off before they were ripe; and in others, the vines loſt their leaves, and the grapes withered: ſo that, towards the end of the month, nothing was more common than to ſee grapes of different degrees of ripeneſs; which made thoſe who were ſufficiently provided with proper veſſels, determine to make their vintage at two different times. Towards the 20th, great numbers of ſtarlings and thruſhes appear'd. I know not for what reaſon they were not ſo fat this year, as they generally are when there is plenty of grapes.

OCTOBER.

During this month, the weather was very ſharp; but the air was clear, and we had no wet.

The vintage was begun about the 6th; and thoſe who could cut their grapes at different times began with the red, the fruit of which was ſufficiently coloured, but not ſo ſweet as it ſhould have been. This wine was pale, but is the beſt of the year.

The vintage was not yet finiſhed, when the ſaffron began to bloſſom: but as the air was ſharp and dry, the flowers did not open all together, ſo that people had time to gather them, and none were loſt. Their chives, which are the uſeful part of this flower, were of a good quality.

Our farmers began to ſow on St. Denis's day, and finiſhed that work by the end of this month, their grounds being in good order. The firſt ſown wheat had already riſen.

NOVEMBER.

The air was very cold all this month, and the ſky almoſt continually cloudy.

Some few grounds which had been left un-ſown laſt month, were ſown in the beginning of this.

December.

As it froze almoſt continually during all this month, the culture of the earth was interrupted, and our horſes were employed in bringing wood from the foreſt; which could not be done in the ſummer, on account of the badneſs of the roads.

General idea of the temperature of the air, and of the productions of the earth, during the Year 1756.

WE may be ſaid, in general, not to have had any froſts this winter, ſince there was not ice enough to fill our ice-houſes. The air having been cold all the ſummer, the vegetation of plants made but little progreſs, tho' the earth was always very moiſt.

Wheat.

The corn came up very thin, and tiller'd but little. The wetneſs of the weather made weeds grow, which, in many fields, got the better of the corn, and choaked it. The ruſt which affected the blades of corn, ſtopt the vegetation, ſo that the plants were greatly ſtinted in their growth. Theſe accidents did more hurt to the grain that grew on ſtiff grounds, than to that which was on lighter ſoils. As we were threatened with rain during the harveſt, our farmers houſed their corn before the weeds were well dried: the conſequence was, that ſome of it heated ſo in the barn, that part of the grain was injured. Thoſe who uſed this grain for ſeed, perceiving that it had been hurt, ſowed it very thick: but ſeveral others ſowed much too thin. The worſt was, that many poor farmers, finding their corn not good enough for ſowing, left part of their fields unſown, rather than buy other corn, which was then worth 24 livres, and which was expected to fall to 18, after the harveſt.

Twenty-four ſheaves of the beſt corn of this year's growth will not yield above 80 pound weight of wheat; and, taking them one with another, there muſt be near 30 ſheaves to produce that quantity; though 12 will do it in a good year. This is not all: the *ſeptier* of beſt new wheat makes but 18 or 20 loaves, and ſometimes but 14 or 15; whereas good old wheat makes 24. Notwithſtanding this difference, the old wheat ſells for no more than 24 or 25 livres, whilſt

whilſt the new varies, according to its quality, from 18 to 21 livres the *ſeptier*.

Oats.

The beſt lands did not yield the moſt oats this year: on the contrary, the worſt produced the greateſt quantities; which has made people call this a good year for that grain. Its quality is good, and it is worth from 5 livres to 5 livres 10 ſols the *ſeptier*.

Barley.

Barley too ſucceeded very well.

Leguminous Plants.

There was ſufficient plenty of peas, beans, and lentils.

Pot-Herbs.

Our kitchen gardens were well ſtored with pot-herbs: and notwithſtanding the continual rains, and the coldneſs of the air, all our melons were very good.

Hay.

As the ſainfoin was very ſhort when it was cut, there was conſequently but little of it: but its quality was good. The meadows afforded plenty of graſs; but the almoſt inceſſant rains prevented its being got in in time, and a great deal of it was loſt.

Hemp.

This year's hemp was of a good quality, and ſucceeded even in pretty dry grounds.

Wine.

The white grapes having burſt very much, the quantity of fruit upon our vines was, in fact, not great: but what there was, promiſed extremely well till about a month before the vintage, when the ſharpneſs of the air made the grapes drop off the bunches, and the bunches themſelves rotted or withered; which obliged many people to make ſeveral vintages, in order to ſave as much as they could. In conſequence of this, the price of old wine roſe from 60 to 100 livres a hogſhead: and the beſt new wines ſold for only 50 livres. The quantity of theſe ſmall wines, which may be compared to thoſe of the year 1725, was not great.

Fruit.

The caterpillars having eaten up all the leaves, and even the buds for the next year's ſhoots, in the autumn of 1755, the trees had but few bloſſoms on them. The caterpillars this ſpring deſtroyed all that had eſcaped thoſe of the laſt autumn; ſo that there were neither pears, apples, cherries, apricots or plums, and very few peaches, in great gardens.

In ſmall ones, where conſtant care was taken to deſtroy the caterpillars, there was a little fruit, eſpecially apples. Wild fruits, ſuch as the acorn, the beech-maſt, *&c.* failed entirely: but there were nuts and cheſnuts in pretty great abundance.

Nurseries and Plantations.

Tho' the caterpillars devoured the firſt tender ſhoots of trees; yet, being full of ſap, they afterwards recovered.

Saffron.

This year's crop of ſaffron was excellent in quality, but very ſmall in quantity: for the ſame ſpace of ground which had produced from 26 to 28 pounds, two years before, yielded this year but 5 or 6: and the ſaffron of this year's growth ſold for no more than 19 livres a pound, whereas that of two years before ſold for 24 livres.

Distempers.

There was no contagious epidemical diſtemper this year.

Cattle.

The larger kind of cattle, ſuch as horſes, cows, and ſheep, were not ſubject to any contagious diſtemper.

Game and Poultry.

This year there were great quantities of hares, thruſhes, larks, partridges and quails.

Our

Our dove-houſes afforded but few young pigeons: and tho' the poultry had plenty of water, numbers of fowls were attacked with the pip and ſhankers in the throat. We have already ſaid how they were cured of this diſtemper.

Height of the Water.

Our rivers were greatly ſwelled during all the winter: they were likewiſe very full all the reſt of the year: but yet our high ſprings afforded no water.

THE END.

Directions to the Binder, for placing the Plates.

Plate I.	at page	382.
II.	. . .	430.
III.	. . .	432.
IV.	. . .	440.
V.	. . .	444.
VI.	. . .	456.

ERRATA.

Page 117. *l.* 9. *for* broad cart-way, *read* broad caſt-way.
224. *laſt line, for* tables, *read* table.

INDEX.

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