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LETTERS AND PAPERS

ON

Agriculture, Planting, &c.

ADDRESSED TO THE

Bath and West of England Society,

FOR THE ENCOURAGEMENT OF

Agriculture, Arts, Manufactures, and Commerce.

VOL. V.

THE HISTORY OF THE

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THE CORRESPONDENCE

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MANUFACTURES,
AND COMMERCE.

VOL. V.

THE SECOND EDITION.

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REVISED EDITION

THE HISTORY OF THE

UNITED STATES

OF AMERICA

BY

JOHN B. HENNINGSEN

Author of

THE HISTORY OF THE UNITED STATES OF AMERICA

AND

THE HISTORY OF THE

UNITED STATES OF AMERICA

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THE HISTORY OF THE UNITED STATES OF AMERICA

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INTRODUCTION.

AFTER a lapse of two years from the printing of the fourth, the Bath Society presents the Publick with the fifth volume of its memoirs. The very favourable reception with which the former volumes have been honoured both at home and abroad, has been flattering to the most active Members of the Society; and the Committee of Papers particularly has felt a proportionate solicitude that the present publication may be found of equal importance.

In the selection now made from the general mass of correspondence, regard has been principally paid to subjects of acknowledged moment, and it is presumed that the style and manner of the following pieces will be

found in some instances masterly; in all clear and perspicuous. To the principal authors, the Society feels itself bound to return thanks for an obliging continuation of former correspondence, and to express a suitable sense of obligation to others.

As the finances of the Society, by an extended patronage, are deemed in a flourishing state, notwithstanding the increased expences which have accrued, the Publick may reasonably expect to hear of the increasing stability and usefulness of this institution. And as the Society has much to hope from the present general disposition to promote improvements in the department of agriculture, that greatest of all national objects, the further communications of practical Gentlemen and intelligent Farmers are warmly solicited.

Should it happen that such communications may not all be deemed of equal value for the publick eye, and some writers may
not

not be gratified with seeing their pieces in the printed list, they may nevertheless be assured that their intentions are well received, and that their hints and experiments are preserved for the inspection and advantage of the members. A considerable number of pieces, which have lately been received, are lying over for future consideration,—and the Committee will not fail to bring them duly forward, with a view to their being approved, and published in a succeeding volume.

Bath, May 31, 1790.



LETTERS

The first part of the paper is devoted to a general
 consideration of the problem. It is shown that the
 problem is equivalent to the problem of finding
 the minimum of a certain functional. This
 functional is defined as follows:

$$J(u) = \int_{\Omega} |\nabla u|^2 dx + \int_{\Omega} f(x) u dx$$

where Ω is the domain of interest, ∇ is the gradient operator, and $f(x)$ is a given function. The minimum of this functional is attained at a function u which satisfies the boundary value problem

$$\Delta u = -f(x) \text{ in } \Omega, \quad u = 0 \text{ on } \partial\Omega$$

where Δ is the Laplace operator and $\partial\Omega$ is the boundary of Ω . The existence and uniqueness of the solution of this problem is well known.

L E T T E R S

TO THE

BATH AGRICULTURE SOCIETY.

ARTICLE I.

On the Improvements in Agriculture that have been successfully introduced into this Kingdom within the last Fifty Years.

BY improvements in agriculture, I understand such an artificial management in the culture of land, as may increase the value of its produce *more* than in proportion to the expence which has been incurred in procuring such increase; or, in other words, Improvements consist of, and are estimated by, the increase of nett profits or gain, acquired by means of art and superior management used in the cultivation of land.

The means of such improvements, I conceive, may be fitly classed or arranged under the following general heads, viz.

VOL. V.

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I. Improve-

1. Improvements in the art of tillage.
2. In the invention of new implements, or improvements of those in use before.
3. In the quantity of seed most proper to be sown, and in the regular distribution of the same both as to distance and depth.
4. In suiting the crop to the nature and condition of the soil.
5. In the rotation, or most beneficial succession of crops.
6. In manures, natural and artificial.
7. In the successful introduction of many new articles into field culture.
8. In the advantages of applying them to rearing and fattening cattle, &c. &c.

SECT. I. *Of Improvements in the Art of Tillage.*

Tillage consists in breaking, crumbling, and pulverizing the soil; which in the early ages of agriculture was performed in a very imperfect manner; but from experience it was found that the more perfectly this was performed, and the cleaner from weeds the soil was kept, the larger, the cleaner, and consequently of the more value was the produce.

Improve-

Improvements in tillage, however, it seems, went on very slowly, till Mr. TULL, of very respectable memory, taught the vast advantages, indeed the necessity, of a more perfect tillage, in order to a more successful and more profitable return.

Improvements which have been made in tillage are of very great importance, as it may truly be said to have been the basis or real foundation on which the successful introduction of all the new articles of field culture depend, as will clearly appear hereafter, when we treat particularly of those articles. When the ground is well tilled, it is in the most perfect condition for receiving the fertilizing principles of the atmosphere. Rain, snow, hail, dews, and hoar frost, &c. convey the nutriment of vegetation, which floats in the air, most plentifully into the bosom of the earth, as deep as it has been broken, and well pulverized; which it imbibes very freely, and incorporates thoroughly therewith. It is the only effectual means of destroying weeds, so necessary to the beneficial growth of all crops, and should be repeated till they are in a great measure destroyed; which, by being continually exposed to the sun and wind, will be much sooner than can be effected by any other means. The roots and fibres of weeds are the ligaments and braces which in a great measure knit and bind the

clods together, which in a manner are perfectly indissoluble, till by being exposed to the vicissitudes of the air, the roots within rot and decay, and the clods, almost by their own gravity, with little or no external pressure, expand of themselves into small crumbles, and are reduced to a perfect state of pulverization, which is as far as tillage can go.

The destroying of weeds, however, is not the only immediate benefit accruing from a due state of tillage; grubs, beetles, worms, and maggots of many different kinds, which abound in many fields, may be greatly diminished, if not entirely extirpated and destroyed, by the well-timed use of the plough, and its auxiliary instruments necessary to the reduction and due pulverization of the soil. Nothing so effectually prevents the ravages of the several tribes of subterraneous insects, as the frequent stirring and crumbling the ground; I have had large patches of several poles square in a field of beans destroyed by the grub of the cock-chaffer; and many hundreds of cabbage plants by a kind of grey grub of less size. Both these execute their mischief under ground. The first eat the roots of the beans even when in kid, when they wither, fall, and die; the latter bites off the stem of the plant just under the surface, and does infinite mischiefs; but I have always found tillage, duly performed, destroy the whole race.

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The improvement the soil acquires by means of frequent and well-timed tillage, is gradual and progressive, and the longer it is kept in tillage, if duly performed, the more fertile it becomes.

One ploughing in the beginning of winter, and a second in the winter, or early in the spring, will be more effectual in pulverizing and fertilizing the soil than half a dozen at any other time of the year. I have at this time a piece of eight acres, which bore wheat last year. It was ploughed in October, and lay till the end of February, when I had it dragged. It is now in fine condition, and the ploughman, who has ploughed it many years, says he never saw it in such fine tilth before. It is a strong piece of ground, and rather damp. I have another piece of six acres adjoining to the latter, exactly of the same texture and temper; this, by reason of the long hard frost, we could not plough till February; it is now so lumpy and obdurate, that I think all the ploughing, rolling, dragging, and harrowing, that can be given to it, will not bring it into proper tilth to plant this season. Such is the mighty difference between ploughing for a spring crop in October and February. ✓

This improvement in tillage is so very clear and certain, that it surprizes one much that it is not

universally practised. But in this country, and I believe in many others, the farmers are led astray by a false policy which obtains among them. Many of them at Michaelmas take in sheep to winter at 4s. 6d. a head, and keep them till the first week in April, so that they are obliged to keep their stubble ground and *eddisbes** for the support of these sheep; and by that means, when their land should be in fine tilth for sowing, they have scarcely a field ploughed; by which means they commonly lose three or four times as much in their spring crops as they receive for the keep of their sheep. It is true, as they observe, it helps them to a little ready money at a time they stand in need of it. But surely it is extreme bad policy to take 4s. 6d. to pay 10s. 15s. or 20s. in eight months after; or lose so much in the nett crop, which is exactly the same thing. It will require at least two acres for the keep of each sheep, so that the farmer receives at most no more than 2s. 3d. per acre, whereas a winter's fallow, if the ground be well prepared, is of more real value than 20s. worth of dung laid on the same. From all which this corollary may be fairly drawn, that the land intended for the crop the following spring, can be put to no use, the advantages of which in general can by any means equal a winter's fallow.

* Grass that comes after mowing.

SECT. II. *Of the Invention of new Implements of Husbandry, or Improvements in the old.*

This article comprehends ploughs of every denomination, drags, harrows, horse and hand hoes, machines and implements which have been invented to perform the several operations of husbandry in a more perfect manner, and with less trouble and expence.

In former times ploughs were very ill-constructed; some little more than scratched the ground, others were made so heavy and clumsy as to require great strength to work them. Less than four horses could do nothing with them. There are now several in use which perform much better, viz. the *Rotheram* or *patent plough*, the *one-wheeled plough*, and the *Norfolk plough*, which I believe is the last, and, it is said, by much the best in use; as it will plough up strong land with two horses only, a man, and no driver; so that it does as much work and quite as well as the strong heavy two-wheeled plough, which requires four horses, a man, and driver; being double the expence of the Norfolk-plough for the same quantity of work. A very great improvement indeed!

But there is another plough in use, which it is said does twice the work of this in the same time, at a
little

little more expence; that is, the *Double Plough*, which ploughs two furrows in the same time any other does one. This plough requires only three horses and a man, but no driver. I have seen it at work in a large field, and go perfectly straight from one end to the other, without the ploughman's ever putting a hand to it. I believe these two last ploughs are the latest and greatest improvements which have been made in this instrument for general use.

There are others of a more modern invention used for particular purposes, of which that with two mould-boards is a valuable invention. With this plough I make the open furrows for planting potatoes, and then compleatly cover the sets by splitting the ridges. When they have been horse-hoed, it again splits the ridges in the intervals, and earths up the plants. It effectually answers the same purpose in all broad drilled crops where the horse-hoe is used, and with half the labour performs the same work as could be done with the common plough, and in half the time.

There are other ploughs of less general use, such as the trenching-plough, which sometimes goes to the depth of eighteen inches; draining-ploughs, and ploughs for denshiring and felling; and lastly, I shall mention a small light plough for ploughing
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the intervals of drilled crops, which may either be in the form of the Rotherham plough, or the one-wheeled plough, either of which would answer the purpose as effectually as any horse-hoe whatever.

SECT. III. *Of the Quantity of Seed most proper to be sown, and on the regular distribution of the same, both as to distance and depth.*

The improvement made by the great saving of seed in modern practice is very great. It is very certain from experiments, most satisfactorily authenticated, that about one-third of the seed which was formerly used, and indeed is still in most places, is fully sufficient. In general it produces a better crop than the whole quantity. In the old husbandry or broad-cast method of sowing, it is usual to allow from two to three bushels of seed-wheat, as the season happens, to a statute acre; but in drilling or setting, as practised in the Eastern counties, it is found that from three to five pecks is quite sufficient; so that the difference between the two modes of planting amounts, at least, to a saving of one bushel and a half per acre. If then these new modes of planting all sorts of grain were equally adopted, the saving, I conceive, would be an addition to the year's produce, a tenth or twelfth of its whole amount. The farmer, therefore, who in any one year might plant one hundred acres of wheat in
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the new method, would save at least one hundred and fifty bushels of seed. If the savings of seed then on one hundred acres would be one hundred and fifty bushels, how amazing would be the amount of the quantity saved on all the tillage lands of Great-Britain!!

This is a very interesting object to individuals, and in a national view one of exceeding great importance. It would therefore be very patriotick to use every means to promote and extend the practice.

This improvement in planting has all the prejudice of the common farmer to contend with. He has been used, perhaps, almost half a century, to sow his land with wheat at the rate of two bushels and a half per acre, and at harvest too frequently has observed he has not half a crop; from which he hastily concludes, that if he had sown but half the quantity, small as his crop was, it would have been but half as great. His land is frequently in very imperfect tilth, very rough, and full of large lumps; however, the seedsman scatters the seed on the surface, and in harrowing, a part is covered so deep as never to appear, another is never covered at all, but is picked up by the birds; so that it frequently happens that not one-third of the seed ever vegetates and arrives at maturity. But in planting
by

by hand, every corn is placed at the intended depth and distance, and not one in a thousand miscarries. This mode of planting has now been in use several years in Norfolk, Suffolk, &c. and is annually extending itself, and doubtless will continue to do so, as in general it produces considerably better crops with so great a saving in the seed. The only objection which can be made to it is the expence of setting it, and the great number of hands it requires; more indeed than can at any rate in many places be procured. In answer to the first objection, it is said the price of planting by hand is now only about 5s. an acre, which is very little in proportion to the increase of produce, and the value of the seed saved. The second objection is entirely obviated by the many instruments lately invented for sowing the seed very regularly at any required depth and distance, either in close drilling to be hand-hoed, or in open drilling with intervals of a proper width for horse-hoeing. It is true these have not been so generally used as might have been reasonably expected; the reason of which, I am fully convinced, is the high price the ingenious inventors have set upon them. Farmers in general are prejudiced against the practice, and *a priori* cannot conceive the possibility of the new mode being any way equal, either in the quantity of produce, or in point of profit, to the old method; therefore will never run the risque of lay-
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ing out sixteen or eighteen guineas to make trial of an instrument, which they are so fully persuaded they should never make the least beneficial use of. If ever the practice of drilling, either *close* or *wide*, becomes general, it must be by the example of men in easy circumstances and superior condition, who are not afraid of expending a few pounds with a view to promote the public good, in which their own is conspicuously included.

SECT. IV. *Of suiting the Crop to the Nature and Condition of the Soil.*

In former times the farmer was governed more by the price a commodity would yield at market, than by the consideration of what the nature and quality of his land was best adapted to produce. But experience, and the introduction of many new articles into field culture, have given him a much larger field to range in; and now a sensible farmer regulates his practice by the consideration of what his land is suited to produce a large and profitable crop of, without too great trouble and expence. For example: Wheat is the great staple article, the prime object of a farmer's care and attention; yet there is much land that is totally unfit to bear that grain, that is applicable to the growth of many other articles which are attended with great advantage. The same observation will hold good in respect to almost

almost every article in culture. Improvements in this article then consist in making art subservient to nature, in reasonably assisting her in her mode of acting, for she seldom can be diverted from her own bias, but at an expence that will be far from proving profitable.

SECT. V. *Of the Rotation or most beneficial Succession of Crops.*

This head comprehends improvements of great magnitude and extent. The articles of culture are commonly divided into two classes, viz. One consists of crops that are said to exhaust and impoverish the land they grow on; the other to ameliorate and improve it. This must be understood in a comparative sense; for properly speaking there are few if any vegetables that are carried off the land they grow on to be consumed elsewhere, but in some measure exhaust and impoverish the soil, and render it less fertile.

The first class, viz. those which are supposed to exhaust the land most, are fibrous-rooted plants, as wheat, barley, rye, oats, &c. The ameliorating includes all the legumenous and tap-rooted plants, as beans, pease, vetches, turnips, parsnips, carrots, clover, &c. Modern improvements are much increased by a judicious succession of interchanges among those articles. An ameliorating following an

an exhausting crop, prepares the land for another exhausting crop, and especially if it be a hoeing crop; for by judicious management the land may be constantly cropped for many years in succession, without the intervention of a fallow every third or fourth year, as was heretofore the practice.

SECT. VI. *Of Improvements by Means of Manures both Natural and Artificial.*

By a manure we understand any substance which being added to, or laid on land, increases its fertility. This we conceive may be effected by means which operate very differently, therefore we shall treat of them under two distinct heads:

1st. Those that act mechanically.

2^{dly}. Those that act chemically.

The substances which increase the fertility of land by mechanical means, are all those which by mere addition and intimate commixion improve its texture. Thus strong, wet, heavy clay, by the mere addition of sharp sand, or fine gravel, may be opened, rendered more light and porous, and consequently much more fertile. And light sandy and gravelly soils, whose open, loose, incoherent texture suffers the rain, dews, &c. suddenly to pass through them, are much improved by the addition of strong binding

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ing loams or clay, which render its texture more coherent and productive of vegetable nourishment. Among these may be reckoned marles of all kinds, chalk, shells, and indeed every kind of substance, which, merely by its texture, has the property of rendering soils that are too adhesive, close, and heavy, more light, open, and porous; and those that are too loose and incoherent, more dense, consistent, and retentive of whatever is added to it intentionally by way of improvement, or happens adventitiously in the course of nature. But marles, chalk, shells, &c. properly speaking, are improvers of the soil, not merely as they correct and amend the texture, but also by their chemical powers, which produce an increase of vegetable nourishment, and give fertility to the ground. So that they act in a double capacity, that is to say, both mechanically and chemically.

It is perhaps of little use to enquire, whether the above substances essentially contain any real vegetable nourishment, or only act ministerially in the procurement and distribution of the same. All absorbent substances are powerful attracters of water, oil, &c. and probably to the power of attraction all their virtue is owing. The humid vapours of the air, which abound with putrid exhalations, are copiously imbibed by those absorbent earths, and from thence are inhaled by the roots and fibres of plants.

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The atmosphere is the grand magazine, the great receptacle of putrid vapours, which are constantly exhaled and flying off from the surface of the earth, and from the whole race of vegetables and animals which subsist upon it. These putrid exhalations constitute the true genuine vegetable *pabulum*, or food of plants; therefore whatever substance of an absorbent nature attracts those principles more powerfully than the soil it is laid on, will, to such land, be a manure, and infallibly improve the same.

Those substances which are of a calcarious nature, and can be burnt into lime, have their powers as manures greatly improved thereby; provided they are used so as to impregnate the soil before their virtue is diminished or impaired by being exposed to the air. Lime, of whatever substance it is made, whether of stone, chalk, or shells, by being exposed to air for a few days, expands and falls into a fine powder, and thereby loses its active principles caused by the fire, and becomes totally effete and dead, possessed precisely of the same virtues as the stone, chalk, or shells, of which it was burnt, and no more. The discovery therefore of the true method of using lime, so as to impregnate the soil with its active principles, is a very great improvement in practical agriculture; for before this was known, large sums of money were expended

expended in laying lime on the surface of land, where it soon became effete and dead, and acted only by its mechanical properties in the same manner the substances of which it was burnt would have done had they never been burnt; so that the whole expence and trouble of burning was so much thrown away.

SECT. VII. *Of the successful Introduction of many new Articles into Field Culture.*

If in the idea of new articles be included those which have been transferred from the garden to the field, the number will be far from being inconsiderable. Turnips, potatoes, cabbage of different kinds, carrots, parsnips, &c. were cultivated for domestick uses, long before the time proposed; but the field culture of these articles for the feed of cattle in any considerable degree, is quite a modern practice. The success which hath attended the use of these articles, hath incontestibly established their great value and importance; but unfortunately their culture hath hitherto been much confined, and is very far from being generally practised.

Many kinds of grasses have likewise been strongly recommended as valuable improvements, which, having answered the sinister views of some of the recommenders, in selling their seeds at a great price,

and upon trial being found greatly inferior to the spontaneous growths of this country, have very deservedly fallen into general difuse, and are no more thought of. There are two articles, however, commonly reckoned among the grasses, which must ever be distinguished and separated from those that have been found usefess, that is to say, Sainfoin and Lucerne; these merit more attention and care than have been usually bestowed upon them, and would well repay the farmer for all his expence and trouble, if bestowed with discretion and judgment, for they certainly might be made improvements of the most valuable kind.

Sainfoin has been sown pretty extensively in some parts, but not so generally by far as it deserves. It generally succeeds well upon chalk, from whence it has been very erroneously concluded, that it will not thrive in a deep soil. It is supposed a hard substratum of chalk prevents the deep penetration of the roots, which is the natural bias of the plant, for it is not known to what depth it would descend in a friable soil that would yield to the perpendicular descent of its root. From hence it is strangely concluded, that the plant in such soil is exhausted of its vigour by the luxuriance of its own roots; and that the produce of the herbage on the surface is

is small in proportion as that of the roots is large. This notion, repugnant as it certainly is to common sense and reason, as well as to experience and observation, is firmly believed and maintained by men of very good abilities; so invincible are prejudices early imbibed, and supported by local customs, and habits of practice long established.

The writer is clearly of opinion, that there are few arable farms in the kingdom which are not capable of great improvement by planting of sainfoin, more especially those which are but poorly provided with good pasture and meadow land. The poorest fields of such farms might by proper management be brought to produce good crops of sainfoin; and land, the natural intrinsic value of which is not more than from 2s. 6d. to 5s. an acre per annum, might certainly, at a very moderate expence, be made worth from 20s. to 40s. This would prove an unspeakable advantage to the occupier as well as to the owner of a farm that is almost wholly arable, as it would enable him to keep a much larger number of milch-cows, and hogs in proportion, and by these means greatly increase the quantity of manure for the improvement of his corn-fields.

The greatest enemies sainfoin has to encounter are grafs and weeds: these, in land that is tolerably good, soon overcome and destroy it, unless the farmer will take the trouble, and be at the expence of keeping it clean. But this is by no means so formidable an undertaking as hath been generally thought, provided the land be very well cleaned and duly pulverized before the seed be sown, and provided also it be sown in rows from fifteen to eighteen inches distant, which is as near as it ought to be sown, if intended for a lasting plantation. At those distances, the intervals between the rows may be kept perfectly clean with a small plough and a narrow drag of about twelve inches wide. With these instruments several acres may be cleaned in a day, and supposing this to be done three times in a summer, the expence would amount but to a trifle. My drag is twelve inches wide, and proves extremely useful in drilled crops of every kind, as also in those of what nature soever that are planted in rows.

Lucerne, under a similar management, would be a very great improvement on arable farms. Indeed an opinion generally prevails, that it requires a much better soil than is commonly found. Crops of all kinds are more abundant on a good than on a bad soil, if they are kept clean; but it is a very
erroneous

erroneous opinion, that lucerne will thrive only on rich land. It may be raised to great advantage on land of a very indifferent quality, by the same means as above recommended for sainfoin, and the same care to keep it free from grass and weeds. I have cut five good crops off such land in one summer, after having been planted five years, without a grain of manure of any kind, except a small sprinkling of turf ashes the second year after sowing the seed. A few acres of either, or both these grasses, with a few more of potatoes, cabbage, or turnips, would enable the occupier of an arable farm to keep from eight to twelve, or even twenty milch-cows, according to the size of his farm, though he should not have an acre of meadow or pasture belonging to the same.

Of articles which are truly useful and entirely new, we know of few that have been introduced within the time mentioned. The turnip-rooted cabbage is a truly valuable root, which was accidentally discovered about twenty years ago, and has been cultivated with great success by several gentlemen, and strongly recommended by them to the attention of the farmer. Both its roots and greens are exceeding good food for cattle, but what constitutes its principal excellence is its extreme hardiness, for it resists the violence of the most rigorous

seasons and severest frosts. When the common turnip and hardiest cabbage have been entirely cut off and destroyed, this has continued its fine verdure, and supplied the kitchen with greens, and the cattle with sweet and wholesome roots, even till the middle of May.

Another new article which has been very lately introduced is the *Mangel Wurzel*, or Scarcity Plant. From the success some few gentlemen have had in its cultivation, it seems to promise to be of the greatest utility for the feed of cattle. However, it is very little known as yet, it being supposed that not one farmer of a thousand has so much as ever heard of the name. It is generally agreed to be a species of the beet, of which there are many. The seeds of both have exactly the same appearance, and the leaves and roots differ only in colour and size, for the manner of their growth is exactly the same; but the leafage of the new sort is said to be much more luxuriant and abundant, and the roots vastly larger.

In order to discover the most advantageous mode of raising this plant, I sowed, or rather set, a quantity of the seed in several different ways in April last. The beginning of July the outside leaves had obtained their full growth, some of which I broke off and offered to the horses and cows, who ate them
 very

very freely; but when offered to the pigs, they seized them with great eagerness, and devoured rather than eat them. The pigs are still fed with them daily, and constantly prefer them to every kind of green food or root that can be given them. Breaking off the leaves takes up much time, and is very troublesome; therefore, when the outside leaves are fully come to maturity, I cut the whole clean off about an inch and a half above the ground, from whence fresh leaves shoot up very freely. My experience is yet too small to speak with confidence; but it seems to me that an acre of this plant, if it takes well, would be sufficient to keep twenty pigs very well for five or six months, say from July to November or December inclusive.

Another article of food for cattle has been lately recommended as the sweetest and best in the world, sold under the title of *Carolina Grass Seed*. I sowed a very small quantity of the seed in my garden in April last; it came up well, and is now in a very flourishing state. Time will discover if it is in any degree superior to many of the spontaneous productions of our own climate. No quantity, I believe, has been hitherto obtained that is adequate to that purpose. From the small trial I have made, it seems no way difficult to propagate, if the soil be well pulverized and clean before it is sowed.

SECT.

SECT. VIII. *Of the Advantages accruing from the introduction of the New Articles above specified into Field Culture, in applying them to the rearing and fattening of Cattle.*

The improvements made by cultivating turnips for the feed of sheep and fattening of cattle, is so generally known, and extensively practised, that it seems unnecessary to say any thing on that head. I will, however, beg leave to observe here, that the opinion generally maintained, that turnips are an improper food for milch-cows, as it spoils the cream and butter by impregnating the milk with the strong flavour of the turnip, appears to me, by repeated experiments, to be ill-founded. The two last winters and springs my milch-cows lived chiefly on turnips, and their butter was found not only as good as my neighbours, whose cows ate none, but was even preferred to it. They say their opinion is grounded on experience as well as mine. The difficulty, I apprehend, lies here: My turnips are pulled, brought home, and given to the cows in the yard; their cows have been used to be turned in upon them, where they pick up the charlock and other weeds which abound among them, for they are never hoed; and to this, and not the turnips, I am persuaded, the disagreeable flavour of the milk is owing. It must be observed that the turnips should

should be given to the cows while they are fresh and firm, for all food when grown putrid and corrupted is unwholsome, and doubtless would affect the juices of the animals that eat it.

Of all the articles we have mentioned, or that is yet known, perhaps very few can equal, and none excel the *Potatoe*. The inestimable value of this root is hardly to be conceived. It is not only an almost constant dish in great and opulent families, but in times of scarcity and dearth, the poor are almost wholly subsisted by it. There are many poor families in this neighbourhood, who the last winter ate them three times a day with a little salt, without a morsel of meat or bread with them. It is true they have been long in use for the food of man, but it is of late date that they have been extensively cultivated for the feed of cattle; and even now, I am pretty clearly of opinion, that if they were much more generally cultivated than they have hitherto been, the farmer would find his account in it, especially where a substitute is much wanted in the winter and spring seasons for the support of his cattle.

Hogs are immoderately fond of potatoes, and will live entirely upon them till they are fit to put up a fattening for pork or bacon; and then, boiled and mixed with barley or pease meal, they fat them
speedily

speedily and make fine meat. Another use I have put them to, which has been little practised, or thought of; that is, for the feed of milch-cows. Three gallons a day, half at night and half in the morning is quite sufficient to keep a large cow in full milk, and the milk as sweet and as good as in the summer months. Nothing excels them for the feed of cows which are fattening their calves for the butcher. I fattened four last spring, which were sold for from 35s. to above 40s. a calf, which was double what I ever sold any for at this place before. Last year, after taking them up, several calves, about six or seven months old, were turned into the potatoe ground with the cows; they fed upon them as kindly as so many pigs, and preferred them to every thing else they could meet with.

I have had no experience of their use as food for horses; but I have been assured by a gentleman who resided some years in Ireland, that he kept his hunter, a stone-horse, entirely upon them instead of corn. He ate nothing else, excepting hay between his feeds of potatoes, as other horses; yet he was as fat, as healthy, as strong, and as full of spirits, as if he had given him all the corn he could eat.

ARTICLE II.

On the Culture of Potatoes by the easiest and most æconomical Means.

[By Mr. JOSEPH WIMPEY, to the Secretary.]

SIR,

SINCE the potatoe has been in universal demand for the food of cattle, as well as of families, their culture hath become an object of general attention and regard. Men of every class, from the princely owner of a palace to the meanest cottager, have exerted their skill in attempting to improve it both in quantity of produce and in goodness. As to quantity, some have succeeded beyond all expectation.

In examining some of those accounts, the writer hath been much surprized to find their culture hath been attended with such enormous expences, even as far, if he remembers right, as 14l. or 15l. per acre. This put him upon considering if a less operose and more æconomical method might not be practicable, by which, though the quantity of produce might be considerably inferior, yet the nett profit might be superior, and that in no small degree, all things considered.

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In pursuit of these ideas, the writer, the two last years, adopted the following method, which fully answered his expectation. A particular of which, containing an exact account of the expences, quantity of produce, amount of the crop at a certain price per bushel, and lastly, the nett profit of two statute acres of land so cultivated in the year 1788, is as below.

In Dec. 1787, two statute acres were ploughed up and lay rough through the winter. The February following, the ground was well dragged, forty cart loads of long dung were then equally spread upon the same, and immediately ploughed in. The beginning of April, furrows were drawn the length-way of the field with a double-breasted plough, at about two feet eight inches distance one from the other, in which the potatoe sets were dropped by hand, at the distance of from 12 to 14 or 15 inches, which were covered by splitting the ridges with the same double-breasted plough, throwing one half of the mould to the right hand, the other half to the left, and by that means forming a ridge over each rank of sets, and leaving a deep furrow in each interval. In this situation they continued till the sets had shot five or six inches.

By that time the weeds began to appear in great abundance. A small common one-wheel plough
was

was then set to work, as near each side of each rank of potatoes as could be without damage to the plants. This operation raised high ridges in the intervals between the rows.

In this state it continued till the weeds began to advance again in their growth. The double-breasted plough was then set to work again, going up the middle of one row, and down another, by which operation each side of the plants were completely earthed up; and before fresh weeds could vegetate, the luxuriance of the greens was such as to completely cover the intervals; so that the whole surface of the field had one uniform appearance.

In this situation they continued till about the 20th of October, when the greens being mostly decayed, and the weather very fine, they were begun to be taken up in the following manner: A strong plough was set deep enough to work below the bed of the roots, with which the ploughman goes up one row and down another, turning the roots up to the surface. Women, boys, and girls, follow the plough, and pick them up in baskets as fast as they are turned out. A pair of drags with long tines are drawn over the ground after it has been picked, by which many are brought up to the surface, which had escaped the pickers. When the whole field has been gone over
in

in this manner, we then give it a clean ploughing and harrowing, by which means very few roots escape. Thus the whole operation is completely gone through, and the land left in the most perfect condition for the immediate reception of a crop of wheat.

An exact account of the produce, expence, and nett profit of two statute acres planted with potatoes in manner aforesaid. Produce 750 bushels; tithe paid in kind deducted, say 75 bushels, leaves 675; which at 1s. per bushel, or three shillings per sack, amounts to - - - - - £.33 15 0

E X P E N C E S.

A clean ploughing in winter	— —	0 12 0	
Dragging in February	— —	0 3 0	
40 loads of long dung, and carriage	- 4	0 0 0	
Spurling ditto	— — —	0 2 0	
Ploughing in the dung	— —	0 12 0	
Striking furrows with double-plough		0 6 0	
Planting and cutting potatoes	— —	0 6 0	
Covering them with double-plough	- 0	6 0	
Sets 15 sacks at 3s.	— —	2 5 0	
Ploughing intervals from the rows	— 0	6 0	
Earthing up the plants	— —	0 6 0	
Taking them up, ploughing up, drawing home, stacking, &c. 3 horses, man, and boy, 5 days	— — — } 1	10 0	
One man, one woman, 5 days	— 0	7 6	
Boys and girls	— —	0 5 9	
A year's rent	— —	2 0 0	
		<hr/>	13 7 3
Nett profit on 2 acres	— —		£.20 7 9
or 10l. 3s. 10½d. per acre.			

But to do justice to the experiment, the succeeding crop of wheat should be charged with at least 4l. and that sum added to the nett profit would amount then to 12l. 3s. 10½d. per acre, for it would have cost so much at least to have brought the barley stubble into so perfect a tilth and fertile condition as the potatoes left it in.

It may be very proper to observe, however, that the culture of potatoes for sale, probably, cannot be extended much farther, in many places at least, the markets being already overstocked, and the price fallen, seemingly more in proportion than the increase in quantity. Three or four years since, the current price of potatoes in this neighbourhood was 6s. per sack, and often more; sometimes as high as 12s. Last year I sold some for 2s. 6d. none for above 3s. and at present I have little prospect of disposing of what I shall have to spare of the above quantity, even at those low prices.

Hence it becomes a question of very considerable importance, what is the real and intrinsic value of this root to the grower when applied to feeding of his own stock, from the time of taking it up to the time of planting, say from October to May following; that is, seven months out of the twelve. If this should be found to answer in any desirable degree,
the

the farmer might with safety cultivate as many as he could consume with advantage, without depending upon a foreign market, which, by means of an exceedingly extended cultivation, is become very precarious. Add to this, the potatoe in itself is a perishable commodity, and when ever so well kept must be disposed of in about eight months, or become totally useless.

But as the above question involves a great deal of *practical* knowledge, which is attainable only by real experiment, and as I am now feeding of different kinds of stock on potatoes, I hope therefore to be able to write on this subject with greater precision, and will beg leave to lay an account of this matter before your respectable Society in some future paper.*

On examining the account of the above experiment, I see little reason for making any alteration in the mode of culture there practised. After the first ploughing in the winter, I think if it were to be followed by a second across the first, and the land thrown up into sharp narrow ridges by one 'bout of the plough, or by the double-breasted plough, the land would be much more effectually exposed to the influence of the atmosphere, and the improvement much greater in proportion, than a half

* Such account will be received with pleasure.

ploughing would amount to, being only an addition of 6s. to the expence; the winter being the season when the fertilizing principles descend most copiously to impregnate the earth.

I should observe, in ploughing up the potatoes, we always take out the coulter, which would cut and damage a great many of them; but in this way the business is performed without the least injury; as a proof of which, I did not see one root that was at all hurt by the plough.

My principal object in adopting this method of cultivation was not the obtaining the largest quantity of produce possible, but rather the largest that could be got consistently with cleaning, ~~ameliorating~~, and improving the soil. This was my first and principal object, and perhaps a more effectual method is not easy to be found. Had the largest quantity of produce been the only thing aimed at, the number of rows might have been doubled, and instead of 32 inches, 16 only might have been taken. The produce in that case, doubtless, would have been much more considerable, but then the land would have lost all the benefit of horse-hoeing.

Since writing the above, I have had the pleasure of reading the learned Dr. *Anderson's* very valuable

teatise on this article. The great accuracy and precision with which his experiments are conducted, are very singular and curious, and his subsequent observations and conclusions not less instructive and useful than they are ingenious and entertaining. His discovery, that the acreable produce is in a great measure in proportion to the quantity (weight) of sets or bulbs planted, (contrary to what obtains in many other articles) is, perhaps, one of the most important discoveries of the present age. And I must add, I have the satisfaction of seeing it in a good measure confirmed by my own practice in the foregoing account.

By that account it appears that I planted fifteen sacks of sets in two statute acres of land; about a third more than I ever allowed before, and I believe than is commonly used. The increase of produce was not only in proportion to the increased quantity of seed by measure, but also in the size and fair appearance of the bulbs, which indeed were so much improved, that I could not help hesitating for a good while, if some mistake had not been committed in the sets planted, which I could by no means account for.

Two of the sets I planted were produced by a friend in London two years before, and were said

to

to be the sorts most in demand in that market. One of them was the kidney sort described by the Doctor, and I think one of the best kinds yet known for the table. The other was a round, white, fair potatoe, the name of which I never learnt, but it was a very good one. The first year of planting, the produce exactly corresponded with the sets, but the second, that abovementioned was so much improved as quite to confound my judgment. This pleasing amendment can be imputed to nothing else but the weight and size of the sets planted. In this I was rather particular, suffering in general none to be planted less than a large pullet's egg; the larger sizes were cut into two, and the largest into four pieces.

For some three or four years past, I have also made some trials of raising potatoes from seed. The events of my trials differ considerably from those of the ingenious Doctor. The first year I had some bulbs as large as a pullet's egg, but I did not then remark any variety of sorts. The largest of these were preserved, and planted the following April. The October following they were carefully dug up, and were as large in general as those produced from old bulbs; many of them from half a pound to a pound and upwards. Among these, very contrary to what happened to the Doctor in his experiments,

there were not less than five or six different species, most of them totally different, not only from the parent stocks, from which the seeds were obtained, but also from every other species I had ever seen, or have to this hour. They were of different colours, figures, and texture. Some a smooth yellowish white, some a dusky brown, some a reddish brown, some had a rough skin, some smooth, some distinct single bulbs of a regular shape, others a congeries of bulbs from 6 to 10 or 12, connected together by a kind of neck, composing a mass, sometimes nearly as big as a half-peck measure. But there was one species which far exceeded all the rest in beauty; many of them were as big as a goose's egg, a fine clear smooth skin of a yellowish white, finely pounced with small crimson spots, the complexion beautiful, and the substance as good as I ever tasted.

The bulbs, which produced the seeds of which these varieties were obtained, were of two very different species, but no more than two. One was an oblong white potatoe of no very common shape. Many of them were gibbous at each end, connected by a part much smaller in the middle, a good family potatoe. The other was of a brownish red colour, finely marbled on the inside with a crimson purple; a very fine juicy potatoe, much in use in this country for feeding hogs, but little valued for family

family use. These two species are all I had at that time; from which the apples which produced the seeds were promiscuously gathered in the same field, and sown together in the same spot.

The Doctor seems to doubt if the sexual system of Linnæus takes place in the propagation of new varieties in this useful plant; but it seems very certain from the above account, that varieties of them are attainable from seed, and that most probably by the blossoms of some plants being impregnated with the male dust of others, similar to what happens to the whole tribe of cabbages, carrots, and parsnips, beets, &c. If this be not admitted, we must have recourse for a solution to *feminal variations* in the primitive sense of the phrase; which is not only infinitely more improbable, but perhaps totally inadmissible and irreconcilable to the principles of sound philosophy. Nothing can be more certain, than that the most minute variation must have had a pre-existing cause competent to its production; otherwise it unavoidably follows that an effect may be produced and exist without any cause at all, which is absurd and impossible.

That the pea tribe continue invariably the same, though they should be reared in the most promiscuous manner, the Doctor seems fully convinced, and

I have nothing to offer against it; but he says also, "all the kinds of beans possess the same property." With all due submission to the Doctor's superior judgment, I must think in this he is certainly mistaken. In 1787, I planted a field chiefly with garden beans of most of the sorts known; they were planted in rows about a yard asunder, in the following order: Mazagan, White-blossom, Long-podded, Sandwich, Toker, and lastly, Windsor. The Mazagan and White-blossom were threshed first, when to my great surprise I found I had quite a new species, or rather several. The Mazagan, instead of their being of their natural colour, were mottled black and white; the White-blossom, instead of their natural jetty shining black, were brown, black, and yellow, blended together, and both much larger than usual. The Long-podded were also very much of the same colour. Here then is an undeniable proof that beans, of some sorts at least, are as subject to seminal variations as any class of plants whatsoever. I assert this with great confidence, as the experiment was not made on a small trifling scale, for I had eight or ten sacks of these beans which I had agreed with a seedsman for at 5s. a bushel. When they were threshed, I wrote him word what happened, and disposed of them among my hogs and horses.

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It may be of some use to observe here, that I suffered no loss by this unexpected accident, as at first was apprehended, for they turned to better account than they would have done if sold at the price abovementioned. I have since found, by repeated experience, that beans are a much more hearty and profitable food for horses than oats. Being out of old oats the two last springs, I substituted horse-beans in their stead. In the room of a sack of oats with chaff, I ordered them a bushel of beans with chaff to serve the same time. It very soon appeared the beans were superior to the oats, from the life, spirit, and sleekness of the horses. Valuing the beans at 40s. per quarter, and the oats at 20s. the keep of the horses with oats would cost just double what it did in beans, and not so well kept neither.

What the Doctor has advanced on the distemper called the *curl* in potatoes, I think very just. That it is generally occasioned by distempered seed, I have not the least doubt. How the seed becomes vitiated and corrupt is another question, which perhaps admits of no satisfactory solution. There are many other ways, I apprehend, by which both animals and vegetables, that are robust and healthy during one part of their existence, become distempered, and even their

their *stamina* vitiated, the remainder; besides hereditary descents, or what they may acquire by *juxta position*.

The smut in wheat, I have long been of opinion, is generated by a very wet season happening during the time of its being in blossom. This I esteem the cause and origin of the disease; but I am well assured it may be, and often is, propagated and continued by using the corn thus vitiated for seed. Last year I made some experiments on smutty wheat, hoping to obtain some information I might rely on. I sowed part of a ridge in drills about twelve inches apart with good sound seed; another part, immediately adjoining, with seed taken from very smutty corn. It had been previously washed in two several waters; what swam at top was carefully skimmed off, and the washing continued till no blackness remained. Another portion of the same ridge, adjoining the former, was drilled with part of the same smutty wheat unwashed, just as it came from the ear, without any preparation whatever; the result was as follows:

The crop from the sound seed was perfectly free from smut, clean, and good. That from the second had many smutty ears among it, perhaps one in twenty. The third and last was miserably smutty indeed;

indeed; I believe half of the ears at least were infected. As all three parcels of seed were sown in the same land, at the same time, in the same manner, and managed the same in every stage of its growth, it seems clearly to follow, that good clean sound seed in a favourable season will produce good sound corn; that seed infected with the smut, though well washed in water, will retain a part of the infection, and produce a smutty crop; and that smutty seed, sown without any washing at all, will produce a crop so smutty as to be of very little value.

In like manner, I apprehend, the potatoe, and perhaps every other kind of vegetable, though originally of the most firm and perfect stamina, may, by an intemperate air, consuming blights, or a combination of unsuspected causes co-operating together, vitiate the original stamina, and induce imbecility and a distempered constitution, which may be propagated through all succeeding generations.

The purest and best means of guarding against and preventing this evil, is to follow the advice given by the very intelligent Doctor, which is to select for seed the largest, fairest, soundest, and best complexioned bulbs; by which means you will most probably avoid those that may be infected with this
destructive

destructive malady. The Doctor hath truly observed, that the curled are always of an inferior size; to which I will add, they are also of so unpleasent an aspect, that an eye of modern discernment will easily distinguish them from those that are found.

Let the seed be judiciously chosen, and planted in the most proper season, there will then be very little reason to fear a profitable crop of good found potatoes, of a desirable size, if managed according to the directions in the former part of this paper.

Impressed with gratitude for the many marks of approbation conferred on me by your very respectable society, I beg leave to recommend this paper to their consideration.

And am, Sir,

With great respect and esteem,

Your obliged humble servant,

JOSEPH WIMPEY.

North-Bockhampton,
Nov. 10, 1788.



ARTICLE

ARTICLE III.

An Enquiry concerning a sure and certain Method of improving small Arable Farms.

[By the same, to the Secretary.]

SIR,

IT is generally thought, and on very good grounds, that small arable farms do not afford the occupier so good a maintenance as dairy farms of the same annual value. That the latter will do well and save money, while the former, with a vast deal more labour and trouble, is starving himself and family. This matter has been fully investigated in a former paper, and the true reason assigned; but a sure and certain remedy, which would enable the farmer to live and pay his rent punctually, is greatly to be wished, and would be of universal convenience. An attempt to effect which is the intended use of this paper.

The advantage and propriety of applying land to the growth of such articles to which nature has most fitly suited it, has been shewn at large, and also that all land which is naturally and properly arable, can by no means be converted into meadow, or valuable pasture of any duration. Such as, from a wild state of nature, overrun with furze, fern, bushes,

bushes, and brambles, has been rendered fertile by means of the plough, must be kept in that improved state by its frequent use, otherwise it would soon revert to that wild barren state which was its original condition.

A farm, therefore, which consists wholly, or almost so, of land that is properly arable, must ever continue arable; for it is not practicable to render it in any degree fertile, but by means of the plough; or to keep it long so, even when it is made so. But though arable land cannot be converted into meadow or pasture proper for a dairy, it may be planted with articles which, it is well known now, will answer the purpose of feeding horned cattle, especially milch-cows, as effectually as good meadow or pasture, producing as much milk, and altogether as rich, as sweet, and as good.

But the great interesting question is, Whether those articles which can be procured only by the heavy expences of ploughing, harrowing, seed, and other operations which necessarily attend their culture and harvesting, will afford as much sustenance in proportion to the expence, as meadow or pasture which is liable to little or none, excepting what is made into hay, the cattle gathering it for themselves as they consume it?

To ascertain this fact, we must enquire, what may be the average expence of keeping a milch-cow on a dairy-farm for any given time? It is said, upon very good authority, that the expence generally is from 3l. to 3l. 10s. per annum. Two acres and a half of pasture fit for this use is sufficient to keep a cow the whole year through, and such land is valued at from 25s. to 30s. per acre. At 25s. suppose, the keeping of each cow would amount to 3l. 2s. 6d. per annum. A dairy farm, therefore, consisting of forty-eight acres at 25s. per annum, would amount to 60l. rent per annum; and the number of cows that might be kept upon such a farm, allowing two acres and a half to each cow, would be nineteen and a fraction, therefore we will say twenty.

In the next place, let us enquire, what would be the average expence of keeping a cow upon food raised in arable land as a succedaneum to grass, &c. rent and every necessary expence included?

We are assured, by unquestionable authority, that a bushel of potatoes, given half at night and half in the morning, with a small allowance of hay, is sufficient to keep three cows a day. On that allowance their milk will be as rich and as good, and the quantity as great, as in the summer months when the cows are in good pasture.

In

In a former paper we have shewn, that an acre of land, properly cultivated with potatoes, will produce 337 bushels, and the total expence of cultivating an acre, rent and tithe included, was 6l. 13s. 7½d. If three cows eat seven bushels per week, then they would eat 365 bushels in a year; and twenty cows would consume 2433 bushels. The question then is, If 20 cows require 2433 bushels to keep them a year, and as above an acre of land properly cultivated will produce 337 bushels nett, how many acres will be required to produce 2433 bushels, or the quantity necessary to feed 20 cows to keep them in full milk the year round? The answer is, Seven acres and a quarter nearly.

If then an acre of land can be cultivated with potatoes, as above, for 6l. 13s. 7½d. the cultivation of seven acres and a quarter will amount to 48l. 8s. 9½d. We have seen, as above, that the rent of a dairy farm, capable of maintaining 20 milch-cows, is upon a medium 60l. but it clearly appears that the same number of cows may be kept equally well on a very small part of an arable farm planted with potatoes for 11l. 11s. 2½d. less than that sum, which is so much in favour of the arable farm; or in other words, seven or eight acres of arable land, under this mode of management, are as much superior to forty-eight acres of meadow or pasture, as the difference
of

of the two sums mentioned; the arable farmer receiving as great a sum for the expenditure of 48l. 8s. 9½d. as the dairy farmer doth for his bare rent of 60l. without reckoning a penny for incidental expences.

It must be observed, that in this statement no allowance is made for the small quantity of hay given to the cows with the potatoes. It must be noted also, that the account of cultivation is charged with 40s. an acre for manure, and some expence of ploughing, which of right is chargeable to the crop of wheat that is to follow. Now if we deduct 40s. an acre from the expence of cultivating the potatoes, it reduces the sum to 4l. 13s. 7½d. and the whole expence then upon seven acres and a quarter is only 33l. 18s. 9¼d. and consequently the keep of 20 cows is little more than half to the occupier of the arable farm, what it is to the occupier of the grazing farm. If this conclusion be fairly drawn, and the calculation free from errors, as I hope and believe, it is matter of the greatest importance, especially to the little arable farmer. It plainly raises him from a state of acknowledged great inferiority, to one altogether as superior.

It may be said, this calculation respects potatoes only; how will this mode of culture answer when
 applied

applied to the growth of other articles of food used as a succedaneum to herbage? Let us try.

By an experiment made on a pretty large scale, lately, by Mr. VAGG, it seems to appear, that cabbage on arable land is much about as superior to natural pasture as potatoes.—His experiment was made on twelve acres of land, which was very far from being the most suitable for a crop of cabbage. The average value about 30s. per acre, and the whole expence of the culture, carting off included, 1l. 14s. 1d. per acre. The rent and expences of cultivating the twelve acres then amounted to 38l. 9s. He says the stock he fed with it was forty-five oxen, and upwards of sixty sheep; that it fed them three months, and that he is very well assured that they proved as fast upon it as they do in the prime months of the season, May, June, and July. Now if, instead of sixty sheep, we reckon fifteen oxen, or that four sheep are about equal to one ox, in which we cannot err much; then sixty oxen were kept well for three months, or, which is the same thing, fifteen oxen for a whole year, for 38l. 9s. and consequently twenty would cost 5l. 5s. 4d. which is not quite 3l. more than the keep of 20 cows cost in potatoes.

It is somewhat extraordinary that two experiments, made on articles so very different in their nature,

nature, should so nearly coincide in their effects when applied to the same purpose. Turnips, turnip-rooted cabbage, carrots, parsnips, and some other articles, by many experiments often repeated, have been found quite adequate to the same valuable purposes, at least so far as to be more lucrative than meadow or pasture. I omit clover and ryegrass, because they have been long in general practice; but are in common very short of the advantages which may be derived from the cultivation of the other articles recommended.

There is one other article, however, which is particularly worthy of the arable farmer's utmost care and attention, which he may rely on with great confidence, if he will be at the pains of thoroughly cleaning his land, and of keeping it so for two or three years after it is planted. The article I mean is Sainfoin. From the miserable appearance it often makes the first year, I long doubted if its success in poor land was not very precarious; but I have now the fullest conviction, that it will grow and produce a very good crop in poor land, provided the soil be dry, and proper care be taken to keep it clean till it be fully established in the ground.

Small arable farms, which in a manner are quite destitute of herbage, cannot well be supplied with

any substitute that is by any means its equal. Indeed one acre of good sainfoin is of more value than two acres of middling meadow or pasture. And as it will thrive so well on a very poor soil, the arable farmer, who either keeps no cows for want of herbage, or keeping them is pinched for food for them, is perfectly ignorant of the advantages attending the culture of this plant, or miserably indolent and inexcusable in not better attending to his interest.

Whatever crop precedes the planting sainfoin, the ground should be ploughed in the winter, and laid up in sharp deep ridges by one bout of the plough, to continue till the beginning of April. Then it should be dragged and harrowed level: and if the land be very poor, it should have some light dressing of ashes, foot, or a compost of lime, earth, and rotten dung, well incorporated together. A small quantity of either of these would greatly encourage the plants in their infant state. The beginning or middle of April, as the season may prove, the seed should be sown, and there would be little danger of its succeeding to one's wish.

Perhaps there cannot be a better nor a surer means of cultivating this very useful plant to the greatest advantage, than by sowing it after potatoes.

The

The horse and hand-hoeing them during their growth, and the ploughing, dragging, and harrowing the ground to clean it of the potatoes, so thoroughly destroy the weeds, and pulverize the soil, that it is made in the most perfect condition for a crop of sainfoin; and though the land may in its nature be very poor, the manuring properly for a crop of potatoes; and that being grown perfectly rotten, the soil is become sufficiently fertile.

Besides the above, perhaps there are very few articles in use as substitutes for pasture, that are equally profitable with carrots and parsnips, when the soil is suitable to their manner of growth and culture. The soil they delight and flourish most in is a deep, light, free soil, which is easily penetrated, and moderately fertile. In such a soil, if properly hoed and set out at due distances, they will arrive at a great magnitude, and the acreable produce be very surprising. Another advantage is, their being so very acceptable to the farmer's stock of every kind. Horses, cows, sheep, and hogs, eat them seemingly with the same appetite, and are equally improved by them. Unfortunately the quantity of such land bears but a small proportion to what is totally unsuitable to them. Hard, stiff, obdurate land, and such as strongly coheres, is quite unnatural to them, and never answers

the expence and trouble; what grows in such land being very short, generally forked, and of small value. Potatoes, cultivated as above directed, would, I think, be as good a preparation for those roots as can well be invented. If the soil be well manured for the potatoes, it will be sufficiently fertile for carrots and parsnips, and, lying through the winter in fallow, will be in excellent order for sowing the seeds of these roots the March following.

Upon the whole of this account, it seems clearly to follow, that an arable farm of 50l. or 60l. per annum, though it has not an acre of meadow or pasture land belonging to it, may by skill and proper management be made to produce as much and as good butter and cheese, as a dairy farm of the same value, and have a large proportion of land left for the growth of corn and other purposes.

For instance; twenty acres of the sixty, I conceive, would be competent to the maintenance of the stock abovementioned, and they might be fitly divided as follows: viz. Six acres of potatoes, two or four of cabbages, two of turnip-rooted cabbage, and two of turnips, making together twelve or fourteen acres; the remainder to be sainfoin; in all twenty acres. The proportion to be varied, and some articles exchanged for others, as the nature of the soil and particular

particular circumstances might require, and as the farmer might think fit and proper. On twenty acres thus planted, I reckon, besides twenty milch-cows, six or eight young cattle, and pigs in proportion, might be well kept on the offal.

It may be asked, should this plan be generally adopted by the farmer, for whose use it is principally intended, if it would not be running out of one extreme into another? If so considerable an increase of milk, butter, and cheese, would not lower the prices of those articles too much, and raise the price of wheat in a greater proportion? That it would lower the prices of these articles is very certain, and it is a very desirable circumstance that it should. At this time, and for six weeks past, butter has been sold in this neighbourhood for nine-pence a pound, and will most probably be sold for ten-pence very soon; whereas, I should hope, the average price might, by the proposed improvement, be reduced to seven-pence.

There is little danger, however, of the price of wheat being advanced by the appropriation of about twelve acres of land annually to the cultivation of the above articles; for the land would be so much improved by the extra tillage given to the soil intended for those articles, and also during their

growth, that I am rather of opinion they would produce more corn than if constantly planted in the usual very imperfect manner.

The greatest obstacle to this mode of managing a small farm (say from 20l. to 60l. per annum) is, the confined or narrow circumstances of the occupiers of such farms. In general their capitals are much too small to carry on their business to any advantage in the present mode of management; but the mode recommended would require an increase of capital to the tune of 200l. or 300l. Less than 400l. would not stock a farm in this way of 60l. per annum at any rate; but a capital of 500l. would be vastly more convenient, and indeed much more to the farmer's advantage.

If the improvements proposed are so interesting to the individuals immediately concerned, how very important are its effects in a political view, as it respects the community at large! If eight acres of land, by skill and management, can be rendered as productive and as profitable as forty-eight acres, whose natural produce is of a medium value, it is virtually increasing the extent of territory in a six-fold proportion; for if every acre of land could by art and industry be made to yield six times the quantity of produce it does at present, the whole
might

might be rendered capable of supporting six times the number of the present inhabitants.

But this is far from being the whole of the advantage that will accrue from it. It will not only increase the quantity of provisions as aforesaid, but it will also find abundance of employment for the poor labourer and his family. In this respect dairy farms are in a manner of no use; they afford little or no employment at all for the poor labourers. Within a few miles of me lives a dairy-man, who milks constantly between twenty and thirty cows. He has no wife, keeps only one maid-servant, has neither man nor boy to assist him, and only hires a woman in the neighbourhood to assist in milking night and morning, for which he pays her 15d. or 16d. per week. This is his whole expence in the management of his dairy; scarce a tenth part of his rent; whereas every arable acre, cultivated with potatoes, &c. as above, will cost four or five times as much as the rent of the land they grow on. What an amazing difference doth this make to the poor of a populous country, and also to those who must either find them employment, or maintain them without any!

I have often employed a poor family in planting potatoes, and also in following the plough and
picking

picking them up when harvested; a man, his wife, and two children, about 12 or 13 years of age. The man I paid 6s. a week, the woman 3s. and the two children 3s. together 12s. A very pretty income for a poor family! At these times they usually got them a few clothes; at other times, when I had no employment for them, they have been often obliged to seek relief from the parish.

It is certainly a matter of great importance to all men in business, to do all in their power to promote the beneficial employment of the poor; it not only serves to alleviate a burthen, which in many places is become intolerable; but is also the surest means of keeping the poor honest. Many of them, I hope, would never have thought of being otherwise, if they had not been first impelled by necessity; who from petty pilferings to get a penny, go on to greater thefts, till they too often go to the gallows; whereas, had they been constantly employed, they would have been neither necessitous nor idle—the two grand sources of all the evils they suffer, and the injuries they do to society!

I am, Sir,

Your most obedient servant,

*North-Bockhampton,
Nov. 25, 1788.*

JOSEPH WIMPEY.

ARTICLE

ARTICLE IV.

Reflections on DRILL-MACHINES, particularly suggested by an Account of one invented by Mr. BARNES.

[By the same, to the Secretary.]

SIR,

I Congratulate the publick on Mr. BARNES's invention of a new Drill-Machine. In Art. xliv. of your 4th volume, he says, "Whenever it shall be fully before the publick, I flatter myself, it will be found to possess, at the price of ten guineas, at least *more* than all the valuable properties contained in other machines of a much higher price." If so, I will venture to add, it has at *least* twice their merit, as being more compleat, and but little above half their price.

The benefit accruing to the publick from improvements in agriculture, by means of new inventions to facilitate its operations and reduce its expences, must ever be in proportion to the extensive use that is made of them; and these again will ever much depend upon the ease and moderate expence at which they may be acquired.

Were

Were I the inventor of any machine or implement in husbandry, which I had reason to think would be acceptable to the publick, I would set it at a price so moderate as could be no impediment to the sale of it. It may be a question, what would in this case be a moderate profit? The profits in trade, when the returns are not very large, we may suppose to run from 10 to 15 per cent. But in this case, where ingenuity is as necessary as diligence, we will suppose twice that sum, or say from 20 to 30 per cent. would not be generally thought immoderate. On these terms, therefore, I should hope, every one who had bestowed his time and pains with a view to serve the publick, would, in the large demands he might have for his instruments, find a full and satisfactory recompence for his ingenuity, expence, and trouble, especially if, in the construction, his principal object was œconomy, as far as could be made to consist with convenience and utility.

Had I the pleasure of Mr. BARNES's acquaintance, I would beg leave to recommend these observations to his consideration, being fully persuaded, he would find the demand for his machine in proportion to the price; the lower in reason he makes it to the publick, the higher his interest would rise in proportion thereto. I am of opinion, where a
man

man sells one machine for fifteen guineas, he might sell fifty for five guineas each. It is easy for every inventor, on this supposition, to calculate which would be most for his interest.

The excellence of all inventions is measured by the quantity of good they afford the publick. Every instrument or machine, therefore, be it ever so ingeniously constructed, and competent to its intended use, becomes almost useless, and of very little value to the publick, if the price be so high as almost totally to obstruct and prevent the sale of it. It is a kind of *felo de se*, and may be fitly compared to a law which permits the importation of certain articles of commerce, upon the payment of customs so immoderate as to all intents and purposes to amount to an effectual prohibition, by which no one is a gainer but the illicit trader.

Here then the ingenious inventor mistakes his interest egregiously; he sacrifices the virtue of the patriot, not to the *real* but to the imaginary interest of the individual, and suffers at once both in his interest and his credit. The surest and most durable patent is moderation of price; those that are purchased confine and restrain the sale, but reasonable prices encourage and promote it, whatever be the commodity at market.

Immoderate

Immoderate taxes are ever unfriendly to trade, and heavy charges and exorbitant expences are not less so to science and the arts. Ingenuity, even mere pretensions to ingenuity, are often taxed as high as any article of commerce. Subscriptions for thousands and tens of thousands are proposed and tendered to the publick, with as much ease, unconcern, and firmness of features now, as the most hardy veteran would have dared to have offered formerly for fives and for fifties. But this is an age in which credulity is become epidemical, and the alchemy and empiricism of BEN JOHNSON'S days are fast gaining ground under another denomination, and in a different form. Should a comick genius arise of equal humour and parts, he might now find as ample a field of imposture to range in as ever disgraced that poet's times. The surest and most effectual means of promoting and extending knowledge for the general benefit of the publick, is to render it attainable on the easiest and least expensive means possible.

I hope no proprietor of any machine now in use will conceive, that any thing is here meant inimical to his interest. It is the writer's sincere wish, that matters might be so ordered, as to render the interest of the proprietors compatible with that of the publick in general. Should the drill husbandry be
generally

generally extended, as there seems to be good reason to expect, I will venture to say, new inventions of machines for drilling will most probably soon appear, of a very simple construction, and at a price so moderate as will rarely be an impediment to their use, even among the lowest class of farmers.

I have been for some years past a considerable speculator in this business, and have used many inventions for performing this mode of planting, hoping to find the easiest, cheapest, and most economical manner possible. However, I am not able to determine the precise manner of planting, so as to produce the most beneficial crops for any series of years in succession. I call that the most beneficial crop, which produces the greatest nett gain upon any given quantity of land, for any given term of years.

For this purpose I have sowed this season several fields of wheat in drills of very different distances, and in different modes. Some were sown in rows of 18 inches distance with a hand-machine, with which at this distance a day-labourer sowed from four to six acres a day, which was completely covered with one tine of the harrows. This simple machine was made by a country carpenter under my directions, and cost only half a guinea. Other fields
I have

I have planted in a very different manner, which indeed, for the three last years, has been my usual custom. The land being well ploughed, I throw it into small ridges with three bouts of the plough. The distance then from the middle of one furrow to that of the next is about four feet six inches. The top of the ridge about a yard wide, and the breadth of the furrow 18 inches. On the tops of the ridges I plant three rows of corn, at the distance of ten inches from each other. This is performed with a machine which makes the channels, drops the corn, and completely covers it, at one operation. This machine was made by the same workman as the former, and did not cost me more than about 30s. This instrument performs extremely well, the corn is come up very regularly, the rows perfect, and the partitions clean. The first machine will sow single rows at any distance, and any seed from a horse-bean to a turnip-feed.

The other instrument will sow one, two, three, or five rows on each ridge, and any sort you please. This last, however, is capable of improvement, and when made as complete as can be desired, I think cannot exceed two guineas and a half. These are the facts on which I ground my prediction; that the time will come when the price of instruments
for

for this mode of planting will be no impediment to the general use of them, if that mode of practice should ever prevail. But I postpone any alteration till I am better satisfied of the most profitable method of planting.

I am, Sir,

Your most obedient servant,

North-Bockhampton,

JOSEPH WIMPEY.

Feb. 14, 1789.

[Mr. WIMPEY's reflections on Drill-Machines contain much important truth—and as such, the Committee could have no inducement to withhold them from the publick. On the contrary, they are inserted as a fresh proof of the estimation in which his correspondence on experimental husbandry is held: but while the Committee agree with Mr. WIMPEY on the inventing small, simple, and cheap machines for small farmers, they are of opinion, that the expence of large and masterly pieces of mechanism, is a small object in comparison with the advantages of greater expedition on a large scale of farming.]



ARTICLE V.

Prefatory Remarks; Hints respecting Potatoes, a Machine for bruising Furze, and a Plan for improving the Wool of this Country.

[By Dr. J. ANDERSON, to the Secretary.]

SIR,

SOME time ago I did myself the honour to write to you, acknowledging the receipt of the letter and parcel you were so kind to send to me, and giving some answer to Mr. ANSTIE'S queries respecting Wool, which I hope you received.

Along with this you will receive some observations on the management of the dairy, particularly with regard to the making of butter, which are the result of experience; and I shall be happy if the members of your society will accept of this as a testimony of my gratitude, and a proof of my desire to forward, as far as in me lies, the beneficent views of your institution.

I have a few more experiments on potatoes, that are nearly ready for being communicated; among other discoveries, the result of these experiments is a method of rearing potatoes so as to have them at
any

any season that may be wanted, at a very small expence. I had potatoes last season without any sort of cover, as large as to weigh from two to three ounces each, by the first of May. If you think the communication of this process will be agreeable to the society, I shall send an account of it. It never has been yet described in any publication that I have yet heard of.

I observe, among the premiums for last year, one is offered for a model of a machine for bruising whins [furze] as food for cattle; I have made use of a machine of that sort, on a farm I have in Aberdeenshire, for many years past, which answers the purpose very well. By the help of an old horse of little value, it can be made to bruise enough for forty head of full-grown beasts, were they to eat nothing else. I meant to have sent a model of it, but as it is probable you may already have got one, I deferred executing it, till I should hear from you whether you had got one or not. I have also cultivated furze as food for horses and cattle with great profit.

In revolving Mr. ANSTIE's queries in my mind, and frequently thinking of the benefits this country might in time derive from being possessed of a very fine kind of wool of her own produce; and the convenience she in certain respects possesses above

all other nations of improving the quality of her wool to a degree that never yet has been known in Europe; I have often wished it were possible to find a few gentlemen who were willing to associate themselves into a society, for the express purpose of improving the quality of British wool. I would propose that it should be done somewhat on the plan of your Society, or the Society of Arts in London, where a small annual subscription only is required from each member, with liberty to withdraw it when they may think proper. The business to be managed by a committee, chosen out of their own number. Should Mr. ANSTIE, or any other public-spirited gentleman in your neighbourhood, think it probable, that such a thing, if proposed, would be likely to take place, I should explain the principles on which it might be conducted, and demonstrate the practicability of it. I could be confident (without having communicated this plan to his Grace) that the Duke of Argyle, whose concurrence would be of great use for perfecting the plan, would not only countenance, but liberally forward the undertaking.

I am, Sir,

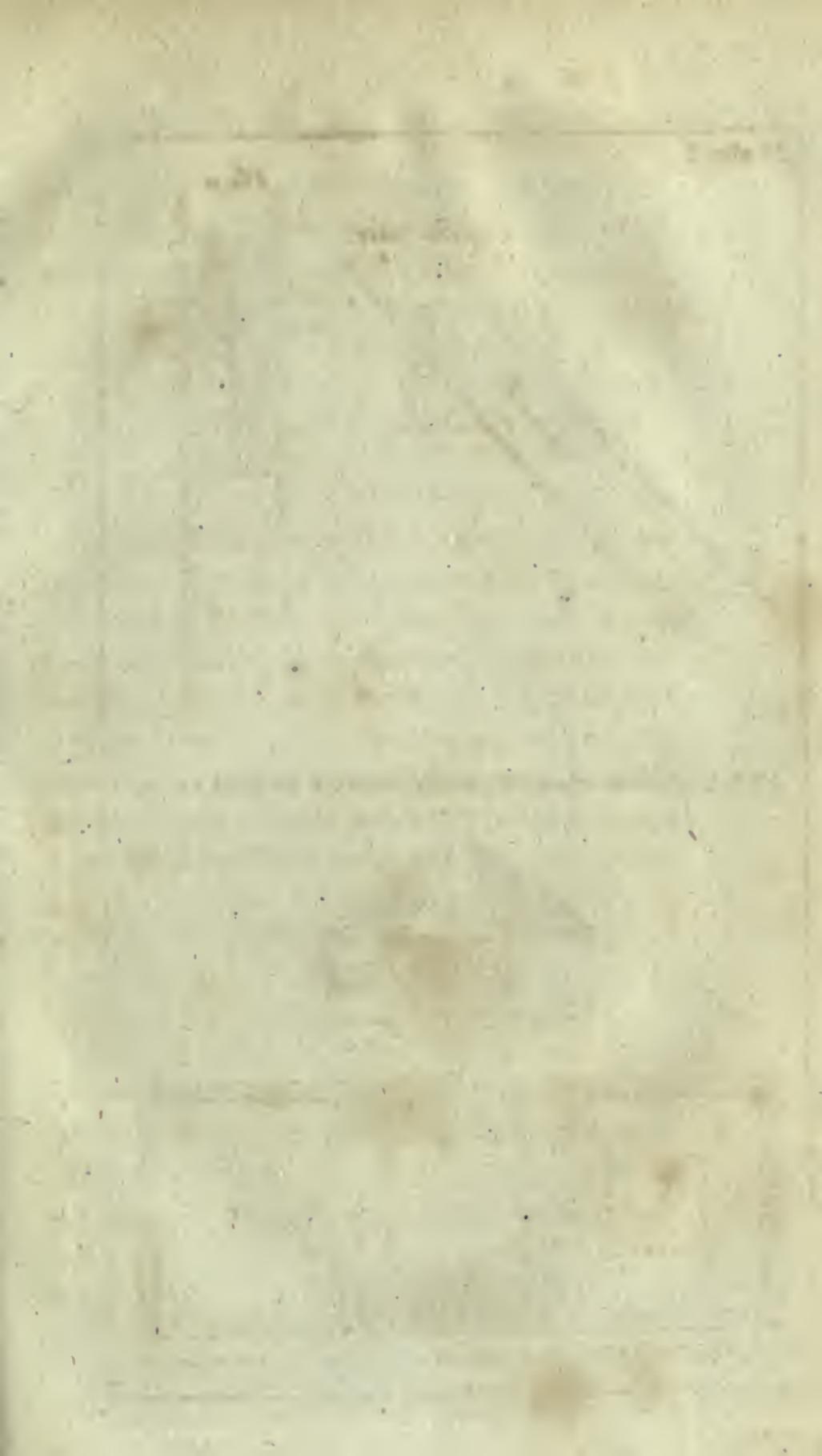
Your most obedient servant,

Cotfield, near Edinburgh,

JAMES ANDERSON.

Feb. 4, 1789.

ARTICLE



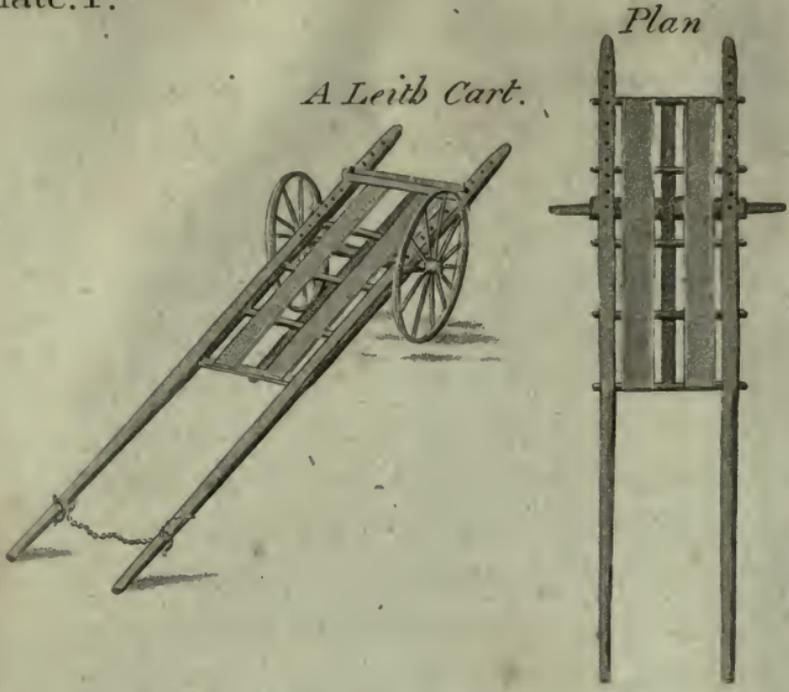


Fig. 2. Section of a Milk House through the line, a. b.

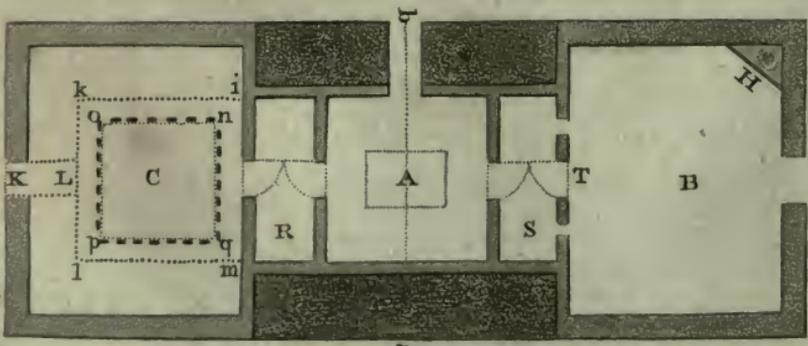
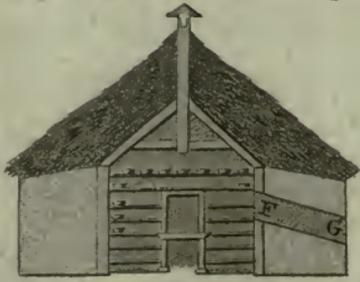


Fig. I. Plan of a Milk-bouse with its necessary appurtenances.

ARTICLE VI.

On the Management of the Dairy, particularly with respect to the making and curing of Butter.

[By J. ANDERSON, LL.D. F.R.S. and F.S.A.S.]

WHEN a dairy is established, the undertaker may sometimes think it his interest to obtain the greatest possible *quantity* of produce, sometimes it may be more beneficial for him to have it of the *finest quality*, and at other times it may be necessary to have both these objects in view, the one or the other in a greater or less proportion; it is therefore of importance he should know how he may accomplish the one or the other of these purposes, in the easiest and most direct manner.

To be able to convert his milk to the highest possible profit in every case, he ought to be fully acquainted with every circumstance respecting the manufacture both of butter and of cheese; as it may in some cases happen that a certain portion of that milk may be more advantageously converted into butter than into cheese, while another portion of it would return more profit if made into cheese. It is not, however, intended in the present essay to

enter into this wide discussion. Here, it is only proposed to treat of the manufacture of butter, leaving the subject of cheese-making to some other person to treat of, who is more conversant in that department than the author of this essay.

The first thing to be adverted to in an undertaking of this nature is, to choose cows of a proper sort. Among this class of animals, it is found by experience, that some kinds give milk of a much thicker consistence, and richer quality than others; nor is this richness of *quality* necessarily connected with the smallness of the *quantity* yielded by cows of nearly an equal size; it therefore behoves the owner of a dairy to be peculiarly attentive to this circumstance. In judging of the value of a cow, it ought rather to be the quantity and the quality of the *cream* produced from the milk of a cow in a given time, than the quantity of the milk itself. This is a circumstance that will be shewn in the future to be of more importance than is generally imagined. The small cows of the Alderney breed afford the richest milk hitherto known; but individual cows in every country may be found, by a careful selection, that afford much thicker milk than others; these therefore ought to be searched for with care, and their breed reared with attention, as being peculiarly valuable.

Few

Few persons who have had any experience at all in the dairy way can be ignorant, however, that in comparing the milk of two cows, to judge of their respective qualities, particular attention must be paid to the time that has elapsed since their calving; for the milk of the same cow is always thinner soon after calving, than it is afterwards; as it gradually becomes thicker, though generally less in quantity, in proportion to the time the cow has calved. The colour of the milk, however, soon after calving is richer than it afterwards becomes; but this, especially for the first two weeks, is a faulty colour that ought not to be coveted.

To make the cows give abundance of milk, and of a good quality, they must at all times have plenty of food. Grass is the best food yet known for this purpose, and that kind of grass which springs up spontaneously on rich dry soils is the best of all.*

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* So little attention has hitherto been bestowed on this subject, that I do not know of any set of experiments that have ever yet been made, with a view to ascertain the effects of any of the natural grasses that spontaneously spring up in abundance on our fields, either on the quantity or the quality of the milk of cows, and few that have been attempted even with regard to those plants that have been cultivated by art as green forage for them; though it be well known that some particular kinds of plants strongly affect the taste, and alter the quality of particular products of milk. It is indeed, in all cases, confidently asserted,

If the temperature of the climate be such as to permit the cows to graze at ease throughout the day, they should be suffered to range on such pastures at freedom; but if the cows are so much incommoded by the heat as to be prevented from eating through the day, they ought in that case to be taken into cool shades for protection, where, after allowing them a proper time to ruminate, they should be supplied with abundance of green food fresh cut for the purpose, and given to them by hand frequently in small quantities fresh and fresh, so as to induce them to eat it with pleasure.* When the heat of

asserted, that old pastures alone can ever be made to afford rich butter or cheese. This, however, I know from my own repeated experience to be a popular error, as I have frequently seen much richer butter made by one person from cows that were fed in the house chiefly with cut clover and rye-grass, than that which was made by others, where the cows were fed on very rich old pastures. Mankind are in general disposed to throw the blame of every failure upon some circumstance that does not reflect on themselves as bad managers. Hence it is that the grass of a farm is often blamed for the want of richness of the butter produced upon it; when, if the circumstances were fully investigated, it would be found to be occasioned by the unskillfulness of the dairy-maid, or the want of attention in the choice of proper cows.

* In very warm climates, where the heat is extremely oppressive to cows, and the flies are exceedingly troublesome, sheds open on one side, the roof being only supported there by pillars, would not afford them such effectual shelter as they would require. In these cases, the sheds should be walled up on both sides, and be left open only at the two ends, which, if properly placed, would produce a continued stream of air throughout the whole building, that would prove highly salutary to the cattle.

the

the day is over, and they can remain abroad with ease, they may be again turned into the pasture, where they should be allowed to range with freedom all night during the mild weather of summer.

Cows, if abundantly fed, should be milked three times a day during the whole of the summer season;* in the morning early, at noon, and in the evening, just before night-fall. In the choice of persons for milking the cows, great caution should be employed; for if that operation be not carefully and properly performed, not only the quantity of the produce of the dairy will be greatly diminished, but its quality also will be very much debased; for if all the milk be not thoroughly drawn from a cow when she is milked, that portion of milk which is left in the udder seems to be gradually absorbed into the system, and nature generates no more than to supply the waste of what has been taken away.

* If cows be milked only twice in the day [24 hours] while they have abundance of succulent food, they will yield a much smaller quantity of milk in the same time than if they be milked three times. Some attentive observers I have met with think a cow in these circumstances will give nearly as much milk at *each time*, if milked three times, as if she were milked only twice. This fact, however, has not, that I know of, been ascertained by experiment. There can be no doubt but they give more, how much is not ascertained; nor whether it would be advantageous in any case to milk them four times, or oftener; or what effect frequent milking produces on the *quality* of the milk.

If

If this lessened quantity be not again thoroughly drawn off, it occasions a yet farther diminution of the quantity of milk generated; and so on, it may be made to proceed in perpetual progression from little to less, till none at all is produced. In short, this is the practice in all cases followed, when it is meant to allow a cow's milk to dry up entirely without doing her hurt. In this manner, therefore, the profits of a dairy might be wonderfully diminished; so that it much behoves the owner of it to be extremely attentive to this circumstance, if he wishes to avoid ruin. It ought to be a rule without an exception, never to allow this important department to be entrusted, without controul, to the management of hired servants.* Its importance will be still more manifest from what follows:

In the management of a dairy, the following peculiarities respecting milk ought to be very particularly adverted to; some of them are, no doubt,

* Cows should always be treated with great gentleness, and footed by mild usage, especially when young and ticklish, or when the paps are tender; in which last case, the udder ought to be fomented with warm water before milking, and touched with the greatest gentleness, otherwise the cow will be in danger of contracting bad habits, becoming stubborn and unruly, and retaining her milk ever after. A cow never lets down her milk pleasantly to the person she dreads or dislikes. The udder and paps should always be washed with clean water before milking; but care should be taken that none of that water be admitted into the milking pail.

known

known in part to attentive housewives, but they never yet, I have reason to believe, have been adverted to as their importance deserves; and by many have never been thought of at all. I put them down in the form of aphorisms, that they may be the more adverted to, and the easier retained.

APHORISM I.

Of the Milk that is drawn from any cow at one time, that which comes off at the first is always thinner, and of a much worse quality, than that which comes afterwards; and the richness goes on continually increasing to the very last drop that can be drawn from the udder at that time.

Few persons are ignorant, that milk which is taken from the cow last of all at milking, which in this country is called *stroakings*, is richer than the rest of the milk—but fewer still are aware of the greatness of the disproportion between the quality of the first and the last drawn milk from the same cow at one milking. The following facts respecting this circumstance were ascertained by me many years ago, and have been confirmed by many subsequent experiments and observations.

Having taken several large tea-cups exactly of the same size and shape, one of these tea-cups was filled

at

at the beginning of the cow milking, and the others at regular intervals till the last, which was filled with the dregs of the stroakings. These were each weighed, the weight of each cup being settled so as to ascertain that the quantity of milk in each was precisely the same; and from a great number of experiments, frequently repeated with many different cows, the result was in all cases thus :

The quantity of cream obtained from the first drawn cup was, *in every case*, much smaller than from that which was last drawn; and those between afforded less or more, as they were nearer the beginning or the end. It is unnecessary here to specify these intermediate proportions; but it is proper the reader should be informed, that the quantity of cream obtained from the last-drawn cup, from some cows, exceeded that from the first in the proportion of *sixteen to one*. In other cows, however, and in particular circumstances, the disproportion was not quite so great; but in no case did I find it fall short of the rate of *eight to one*. Probably, upon an average of a great many cows, it might be found to run as *ten or twelve to one*.

2dly. The difference in the *quality* of the cream, however, obtained from these two cups, was much greater than the difference in the *quantity*. In the
first

first cup the cream was a thin tough film, thinner and perhaps whiter than the paper on which I write; in the last, the cream was of a thick *butyrous* consistence, and of a glowing richness of colour, that no other kind of cream is ever found to possess.

3dly. The difference in the quality of the *milk* that remained after the cream was separated, was perhaps still greater than either in respect to the quantity or the quality of the cream. The milk in the first cup was a thin bluish liquid, like as if a very large proportion of water had been mixed with ordinary milk; that in the last cup was of a thick consistence and yellow colour, more resembling cream than milk, both in taste and appearance.

From this important experiment it appears, that the person who, by bad milking of his cows, loses but half a pint of his milk, loses in fact about as much cream as would be afforded by six or eight pints at the beginning, and loses besides that part of the cream which alone can give richness and high flavour to his butter. Many other useful corollaries may be drawn from it, which I do not at present stop to enumerate. Some of them will occur in the sequel.

APHORISM II.

If milk be put up in a dish, and allowed to stand till it throws up cream, that portion of cream which rises first to the surface is richer in quality, and greater in quantity, than what rises in a second equal portion of time; and the cream that rises in the second interval of time is greater in quantity and richer in quality than that which rises in a third equal space of time; and that of the third than the fourth, and so on, the cream that rises decreases in quantity, and declines in quality continually, as long as any rises to the surface.

My experiments not having been in this case made with so much accuracy as in the former, I have not been enabled to ascertain the difference in the proportion that takes place in equal portions of time; but they have been so often repeated as not to leave any room to doubt the fact; and it will be allowed to be a fact of no small importance in the management of the dairy. It is not certain, however, but that a greater *quantity* of cream may upon the whole be obtained from the milk by taking it away at different times, but the process is so troublesome as not to be counterbalanced by the increased quantity obtained, if indeed an additional quantity be thus obtained, which is not as yet fully certain.

APHORISM

APHORISM III.

Thick milk always throws up a smaller proportion of the cream it actually contains to the surface, than milk that is thinner, but that cream is of a richer quality; and if water be added to that thick milk, it will afford a considerably greater quantity of cream than it would have done if allowed to remain pure; but its quality is at the same time greatly debased.

This is a fact that every person attentive to a dairy must have remarked; but I have never heard of any experiment, that could ascertain either the precise amount of the increased quantity of cream that might thus be obtained, or of the ratio in the decrease of its quality; but it ascertains the effects at least of mixing water with the milk in a dairy; and the knowledge of this fact will enable attentive persons to follow that practice which they think will best promote their own interest.

APHORISM IV.

Milk which is put into a bucket or other proper vessel, and carried in it to any considerable distance, so as to be much agitated and in part cooled before it be put into the milk-pans to settle for cream, never throws up so much nor so rich cream, as if the same milk had been put into the milk-pans directly after it was milked.

In this case, it is believed the loss of cream will be nearly in proportion to the time that has elapsed, and the agitation it has sustained after being drawn from the cow. But I am not as yet in possession of any experiments that sufficiently ascertain how much is to be ascribed to the time, and the agitation, taken separately. On every branch of agriculture we find experiments wanting at each step we advance in our enquiries. The labours of no one man can complete the whole; but it is the duty of every enquirer to point out as he goes along where they are wanted.

From the above facts the following corollaries seem to be clearly deducible:

1st. It is of importance that the cows should be always milked as near the dairy as possible, to prevent the necessity of carrying and cooling the milk before it be put into the dishes; and as cows are much hurt by far-driving, it must be a great advantage in a dairy farm to have the principal grass fields as near the dairy, or homestead, as possible.

2^{dly}. The practice of putting the milk of all the cows of a large dairy into one vessel, as it is milked, there to remain till the whole milking be finished before any part of it is put into the milk pans, seems to be highly injudicious, not only on account of the
 loss

loss that is sustained by agitation and cooling, but also, more especially, because it prevents the owner of the dairy from distinguishing the good from the bad cow's milk, so as to separate these from each other, where it is necessary. He may thus have the whole of his dairy product greatly debased by the milk of one bad cow, for years together, without being able to discover it.* A better practice therefore would be, to have the milk drawn from each cow separately put into the creaming pans as soon as it is milked, without being ever mixed with any other. Thus would the careful *dai*† be able on all occasions to observe the particular quality of each individual cow's milk, as well as its quantity, and to know with precision which of his cows it was his interest to dispose of, and which of them he ought to keep and breed from.

* I once saw a cow that gave milk which could never be made to yield any butter at all, though it had the appearance of being very rich milk. The person who sold that cow had had her several years, along with a good many others, without having so much as had any suspicion of this peculiarity. It was only discovered when she came into the possession of a person who had but one cow.

† I beg leave here to adopt a provincial word, which is strongly expressive, and much wanted in the English language. *Dai*, or *dei*, in Aberdeenshire, denotes the person who has the superintendance of a dairy, whether that person be male or female. In that sense it is here employed. *Dairy-maid*, which is the only English word nearly equivalent to it, denotes a person of an inferior station, who, under the superintendance of the former, executes the menial offices of the dairy.

3dly. If

3dly. If it be intended to make butter of a very *fine quality*, it will be adviseable in all cases to keep the milk that is first drawn separate from that which comes last; as it is obvious that, if this be not done, the quality of the butter will be greatly debased, without much augmenting its quantity. It is also obvious, that the quality of the butter will be improved in proportion to the smallness of the proportion of the last-drawn milk that is retained, so that those who wish to be singularly nice in this respect, will do well to retain only a very small proportion of the last-drawn milk.

To those owners of dairies who have profit only in view, it must ever be a matter of trial and calculation, how far it is expedient for them to carry the improving of the quality of their butter, at the expence of diminishing its quantity. In different situations, prudence will point out different kinds of practice as most eligible; and all persons must be left, after making accurate trials, to determine for themselves. It is likewise a consideration of no small importance, to determine in what way the inferior milk that is thus to be set apart, where fine butter is wanted, can be employed with the greatest profit. In the Highlands of Scotland they have adopted, without thinking of the improvement of their butter, a very simple and oeconomic
 practice

practice in this respect. As the rearing of calves is there a principal object with the farmer, every cow is allowed to suckle her own calf with a portion of her milk, the remainder only being employed in the dairy. To give the calf its proportion regularly, it is separated from the cow, and kept in an inclosure along with all the other calves belonging to the same farm. At regular times the cows are driven to the door of the calves' inclosure, where the young ones fail not to meet them. Each calf is then separately let out, and runs directly to its mother, where it sucks till the dairy-maid judges it has had enough, when she orders it to be driven away, having previously shackled the hinder legs of the mother, by a very simple contrivance, to oblige her to stand still. Boys drive away the calf with switches, and return it to the inclosure, while the dairy-maid milks off what was left by the calf. Thus they proceed till the whole of the cows are milked, and thus do they obtain a small quantity of milk, it is true, but that milk of an exceeding rich quality; which, in the hands of such of the inhabitants as know how to manage it, is manufactured into the richest marrow butter that can be any where met with. This richness of the Highland butter is universally ascribed to the old grass the cows feed upon in their remote glens, but it is in fact chiefly to be attributed to the

practice here described, which has long prevailed in these regions.* Whether a similar practice could be œconomically adopted elsewhere, I do not take upon me to say, but doubtless other secondary uses might be found for the milk of inferior quality; on some occasions it might be converted into butter of an inferior quality; on others it might be sold sweet, where the situation of the farm is within reach of a market-town; on other occasions it might be converted into cheeses, which, by being made of sweet milk, would be of a very fine quality if carefully made;† and still other uses might be devised for

* And perhaps in some measure to the nature of the beast.

† The making of cheese has never yet been reduced to scientific principles, and consequently the reasoning relating to it is very inconclusive. It is in general supposed that the goodness of cheese depends almost entirely upon its richness, by which is meant the proportion of oily matter, whether natural or extraneous, it contains; nothing however is more certain, than that this opinion is erroneous. Sometimes a very lean cheese is much better tasted than one that is much fatter; and, which will appear to most persons still more extraordinary, it frequently happens that a cheese that tastes soft and fat, is much leaner than one that is hard, dry, and sticky. The mode of manufacturing it occasions this, and not the quantity of cream it contains. It is very possible, by art, to make poor skim-milk cheese assume the soft buttery taste and appearance, even of cream-cheeses. This subject, therefore, deserves highly to be more particularly elucidated than it hitherto has been.

Connected as it is with the object discussed in the text, I beg leave to suggest the following particulars, as a proper object of examination and experiment, viz. Is the quantity of caseous matter afforded by

milk

for its application, which I cannot now stop to enumerate.*

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4thly. If

milk necessarily connected with the proportion of cream that milk contains, or does it depend upon some other principle not hitherto investigated? Without pretending to decide on this question, I feel myself strongly inclined to believe it does not depend upon the quantity of cream. It is well known that cow's milk, which always throws up more cream, and that of a much richer quality than ewe milk, does in no case afford above one half the proportion of cheese that ewe milk does. Nor can this singular tendency of ewe milk, to yield a great proportion of curd, be attributed to its superior thickness; for cow milk can be often had that is thicker and richer than ewe milk, but it always affords a much smaller proportion of curd. From these considerations, it is not impossible, but it might be found upon a careful investigation, that the refuse milk, which ought to be separated from the other in making the best butter, might be equally proper, or very nearly so, for making cheeses, as if no such separation had been made. I therefore recommend this as a proper object of experimental enquiry.

* I shall here mention one mode of managing milk, by means of which the inferior kinds of it might, on many occasions, especially within reach of towns, be disposed of to great advantage. Take common skimmed milk when it has begun to turn sour, put it into an upright stand churn, or a barrel with one of its ends out, or any other convenient vessel. Heat some water, and pour it into a tub that is large enough to contain with ease the vessel in which the milk was put. Set the vessel containing the milk into the hot water, and let it remain there for the space of one night. In the morning it will be found that the milk hath separated into two parts, a thick cream-like substance which occupies the upper part of the vessel, and a thin serous watery part, that remains in the bottom; draw off the thin part (called here *swigg*) by opening a stop-cock placed for that purpose close above the bottom, and reserve the cream for use. Not much less than the half of the milk is thus converted into a sort of cream, which, when well made, seems to be as rich and fat as real cream itself, and is only distinguishable from that by its sourness. It is eaten with sugar, and
 esteemed

4thly. If the *quality* of the butter be the chief object attended to, it will be necessary not only to separate the first from the last drawn milk, but also to take nothing but the cream that is first separated from the best milk, as it is this first rising cream alone that is of the prime quality. The remainder of the milk, which will be still sweet, may be either employed for the purpose of making sweet milk cheeses, or it may be allowed to stand to throw up cream for making butter of an inferior quality, as circumstances may direct.

5thly. From the above facts, we are enabled to perceive that butter of the very best possible quality can only be obtained from a dairy of considerable extent, when judiciously managed; for when only a very small portion of each cow's milk can be set apart for throwing up cream, and when only a very small proportion of that cream can be reserved as of the prime quality, it follows, that, unless the quantity of milk were upon the whole very considerable, the quantity of prime cream produced would be so small as to be scarcely worth the while for manufacturing separately.

esteemed a great delicacy, and usually sells at double the price of fresh unskimmed milk. It requires practice, however, to be able to make this nicely; the degree of the heat of the water, and many other circumstances, greatly affecting the operation. These things practice best discovers.

6thly. From

6thly. From these premises we are also led to draw another conclusion, extremely different from the opinion that is commonly entertained on this subject; viz. That it seems probable that the very best butter could only be with œconomy made in those dairies where the manufacture of cheese is the principal object. The reasons are obvious:—If only a small portion of the milk should be set apart for butter, all the rest may be made into cheese while it is yet warm from the cow and perfectly sweet; and if only that portion of cream which rises during the first three or four hours after milking is to be reserved for butter, the rich milk which is left after that cream is separated, being still perfectly sweet, may be converted into cheese with as great advantage nearly as the newly-milked milk itself.

But as it is not probable that many persons could be found, who would be willing to purchase the very finest butter made in the manner above pointed out, at the price that would be sufficient to indemnify the farmer for his trouble in making it; these hints are thrown out merely to satisfy the curious in what way butter possessing this superior degree of excellence may be obtained, if they choose to be at the expence; but for an ordinary market, I am satisfied, from experience and attentive observation, that if

in general about the first drawn *half* of the milk be separated at each milking, and the remainder only be set up for producing cream, and if that milk be allowed to stand to throw up the whole of its cream, even till it begins sensibly to taste sourish, and if that cream be afterwards carefully managed, the butter thus obtained will be of a quality greatly superior to what can usually be obtained at market, and its quantity not considerably less, than if the whole of the milk had been treated alike.* This, therefore, is the practice that I should think most likely to suit the frugal farmer, as his butter, though of a superior quality, could be afforded at a price that would always insure it a rapid sale.

* Among other reasons that induced me to separate about the half of the milk, the following may be stated. Whilst I was employed in making the experiments on milk abovementioned, it chanced that among my cows there was one which had missed having a calf that season, and still continued to give milk, (a cow in these circumstances we here call a *farrow* or *farra* cow.) Her milk, as is not uncommon in these circumstances, tasted sensibly salt. On trying the different parcels of that milk, however, it was perceived that the first-drawn milk was extremely salt to the taste, and that the last was perfectly sweet. On an after trial made with a view to ascertain what proportion of the milk was salt, it was found that the saltness decreased gradually from the beginning, and was entirely gone when nearly one half of the milk was drawn off, so that all the last-drawn half of the milk was quite sweet. I intended to have tried if other nauseous tastes that sometimes affect milk, such as that from turnips, cabbages, &c. were peculiarly confined to the first-drawn milk or not; but other avocations prevented me from ascertaining this fact.

From

From these general observations on milk, it is necessary we should proceed to particulars. No dairy can be managed with profit, unless a place properly adapted for keeping the milk, and for carrying on the different operations of the dairy, be first provided. The necessary requisites of a good milk-house are, that it be cool in summer, and warm in winter, so as to preserve a temperature nearly the same throughout the whole year; and that it be dry, so as to admit of being kept clean and sweet at all times. As it is on most occasions difficult to contrive a place within the dwelling-house that can possess all these requisites, I would advise that a separate building should be always erected, which, upon the plan I shall now describe, may in every situation be reared at a very small expence, and will answer the purpose much better than any of those expensive structures I have seen, that were built by noblemen or gentlemen for this use.

This structure ought, if possible, to be erected near to a cool spring, or running water, where easy access can be had to it by the cows, and where it is not liable to be incommoded by stagnant water. It should consist of a range of narrow buildings as in the plan;* that division in the middle, marked A, being the milk-house properly so called. The walls of this

* See the plate annexed,

building

building should be reared of brick, or of stone and lime, all round the inside; this wall need not exceed in thickness one brick in length, or if of stone, about one foot thick; beyond that, the wall which is full six feet in thickness, should be made of sod on the outside, and earth rammed firm within that. The inside wall of this building may be seven or eight feet high in the sides, on which may be placed the couples to support the roof, and the walls at the gables carried up to the height of the couples. Upon these should be laid a roof of reeds, or thatch, that should not be less than three feet in thickness, which should be produced downward till it covers the whole of the walls on each side; but here, if thatch or reeds be not in such plenty as could be wished, there is no occasion for laying it quite so thick. In the roof, exactly above the middle of the building, should be placed a wooden pipe of a sufficient length to rise a foot or two above the roof, to serve occasionally as a ventilator. The top of this funnel should be covered, to prevent rain from getting through it, and a valve fitted to it, that by means of a string could be opened or shut at pleasure. A window also should be made upon one side for giving light, the structure of which will be best understood from the section of this part of the building, which is represented at Fig. 2. F. G. It is necessary

sary to specify, however, that this aperture should be closed by means of two glazed frames, one on the outside at G, and the other on the inside at F. I presume it is hardly necessary to inform the reader, that the use of this double sash, as well as the great thickness of the wall, and of the thatch upon the roof, as also of the buildings at the end of it, are to render the temperature of this apartment as equal as possible at all seasons of the year, by effectually cutting it off from having any direct communication with the external air.

The apartment marked B, is intended to serve as a repository for the utensils of the dairy, and a place in which they may be cleaned, and put in order, to be ready when they are wanted. For this purpose ranges of shelves may be placed all round the walls, and tables and other conveniences placed where necessary. Here the walls are thinner than the other, and may be built wholly of brick or stone; nor is there a necessity for having the thatch here so thick laid on as in the middle division. In one corner at H, is placed a cauldron of a convenient size proportioned to the dairy, for warming water to scald the vessels, over a close furnace, the flue of which terminates in a chimney carried slanting over the door in the gable, above which it rises upright, and there emits the smoke.

The

The other apartment, C, may be employed as a kind of store-room, in which the cured butter, and other products of the dairy, and spare utensils, may be locked up, till it becomes convenient to transport them elsewhere.*

[If

* If the dairy be situate so near a town as that ice could be disposed of with profit in summer, it might be very useful to convert this apartment into an ice-house, which would be on many occasions a very convenient appendage of the dairy. All that would be necessary in this case, would be to build the walls in the same manner, and make them of the same thickness, with those of the apartment A, as marked by the dotted lines i, k, l, m. The thatch being also laid on to the same thickness. If this were intended, firm posts of wood ought to be placed in the floor, as marked in the plan, n, o, p, q, so as to form an inner square, with an open walk all round of two feet in breadth. Within these posts should be placed hurdles of a convenient shape, formed of wicker work. The wands of which they are made having been all peeled, and previously dipped in warm coal tar, to preserve them from rotting. Within this square is the receptacle for the ice. The ice-house to be filled by opening the double doors at K.L. which should then be closed, not to be opened till it was again to be filled, and the aperture between them to be filled with straw rammed firm, to prevent the admission of air by that means. The ice to be taken out occasionally, as it may be wanted, through the milk-house.

Many would be the conveniences the dairy would derive from this accommodation, and small the expence. By means of it, the products of the dairy could be always cooled to the degree in summer that should be found to give them their greatest perfection. Other advantages might occasionally be derived by the attentive farmer from this easily obtained accommodation; one of which I shall here mention:

BEEs in this climate are found to be a very precarious kind of stock, though, where they do thrive, they are extremely profitable. The circumstance that chiefly occasions their failure here, is the variableness of our climate. In winter we have often mild warm days, little inferior

[If cheese were the object of the dairy, another additional building, very differently constructed, would be wanted, which I do not here specify.]

The smaller apartments, R and S, are merely cavities formed in the thickness of the partition wall, that may be employed for any use that shall be found convenient, the double doors on these passages being intended merely to cut off more effectually all communication between the external air and the milk-house, when either the great heat

to that we experience in summer; and in the spring especially, it frequently happens that a warm morning is suddenly changed to a nipping frost, or sleety rain. During these mild intervals in winter, the bees are roused from their sleepy state, and being unable to get any food abroad, they are under the necessity of consuming the stores they had provided for themselves, which being soon exhausted they then perish for want. In the spring also, when they are invited abroad by the warmth of the weather, they in vain search for flowers from which they might derive nourishment, and are frequently chilled by the cold, before they can return to the hive. No mode that can be conceived is so effectual to prevent these accidents, as that of putting them into an ice-house in the beginning of winter, where they might be kept till the spring was so far advanced as that little danger was to be apprehended from bad weather. During all this time they would remain in a state of torpor, so as to have no need of food, and would be ready to begin their labours with vigour in the spring, when the mild weather invited them abroad. Some will think that the cold of an ice-house would make them perish entirely; but bees often experience in Russia and Poland a degree of cold that is sufficient to freeze even quicksilver, without being killed, which is so much beyond any cold that ever takes place in a British ice-house, as leaves no room for anxiety on that head,

or great cold of that may render it necessary. The thatch above these small apartments ought to come one foot lower within than in the milk-house, the more effectually to bar all communication of air from the outer apartments, at the place where the couples are placed. When the air is temperate, the door at T. may in general be left open to facilitate the entry to and from the milk-house on ordinary occasions. All the doors open as marked by the dotted lines.

Through each of these doors, as well as the outer doors of the apartments B and C, ought to be made an aperture of about a foot square, having a small door exactly fitted to it, that can be opened and shut at pleasure. Over the inside of each of these apertures should be stretched a piece of fine gauze covered with a fine netting of wire, so that when the air was temperate, and the wind blowing in a proper direction, by opening these little doors, a draught of air would be carried through the whole of these buildings that would keep them sweet and dry, without admitting flies or other vermin.

The whole of these apartments should be neatly plaistered with lime on the inside of the walls and cieling. The apartment A at least should also be paved with flat stones, that should be raised six inches

inches higher than the surface of the ground without, having slanting gutters readily to convey water or any other liquid that might be accidentally spilt there, (but it is a slovenly dairy-maid who slabbers her floor.) The walls all round should be lined with shelves of a convenient breadth in ranges one above the other, on which the dishes may be placed; and in the middle should stand a large table, marked by the dotted lines on the plan, which if made of stone will be found to be more cleanly and convenient than any other material. Beneath it a piece of the pavement, about a foot in breadth, should be raised six inches higher all round than the level of the floor, so as to form a trough within it for holding water, the uses of which will be afterwards specified. This basin may be emptied entirely at pleasure, by opening a hole that allows the water to run into the common gutters.

The intention of all these contrivances, it will easily appear, is merely to enable the attentive owner of a dairy to keep his milk in a proper degree of temperature, both during the summer and the winter season, without much trouble or expence to himself; as any considerable variation in the degree of heat tends greatly to derange his operations, and to diminish the value of the products of the dairy. If the heat be too great, the
milk

milk suddenly coagulates, without admitting of any separation of the cream, and it is so suddenly rendered sour as greatly to mar every operation; if, on the other hand, the milk be kept in too cold a temperature, the cream separates from it slowly and with difficulty, it acquires a bitter and disagreeable taste, the butter can scarcely be made to come at all, and when it is obtained is so pale in the colour, so small in quantity, so poor to the taste, hard and brittle of consistence, and of so little value in every respect, as to bring a very low price at the market, compared to what it would have produced had it been preserved in a proper degree of warmth. To avoid, therefore, as much as possible, both these extremes, the milk-house, properly so called, is here placed in the centre of the building, into which there is no access directly from the open air; nor even from the porch, but through a double door, one of which ought always to be shut before the other be opened, when either the heat or the cold of the weather is excessive, though at other times this precaution may be omitted. The walls of this part of the building are made of earth so thick, and the roof of thatch so thick also, as directed, because it is found these substances transmit heat or cold with less facility than any others that can easily be had, so that a very long continuance either of hot or cold weather,

weather, would have no sensible effect in altering the temperature of this chamber; and if it should at any time acquire a small degree of heat or cold more than was desirable, and this were corrected by artificial means, it would retain that artificial temperature for a long time. These are the advantages proposed to be derived from this simple mode of construction.

Experiments have not yet been made to ascertain what is the precise degree of heat that is the most favourable for the different operations of the dairy. From the trials I have made myself, I have reason to believe, that when the heat is from 50 to 55 degrees on Fahrenheit's thermometer, the separation of the cream from milk, which is the most important operation of the dairy, goes forward with the greatest regularity. I am therefore inclined to think, that this will be found to be the temperature that ought to be aimed at in the dairy; but I do not here pretend to decide with a dogmatick precision; a considerable degree of latitude in this respect may perhaps be allowable; but from the best observations I have been able to make, it seems to me highly probable, that when the heat exceeds 60 degrees, the operations become difficult and dangerous, and when it falls below the 40th degree, they can scarcely be carried forward with *any degree* of œconomy

œconomy or propriety. Till farther experiments, therefore, shall ascertain this point, we may take it as a safe rule, that the heat should be kept up, if possible, between the 50th and 55th degree; and to ascertain this point, a thermometer, graduated by Fahrenheit's scale, should be hung up perpetually in the milk-house, to give notice to the owner of any alterations in the temperature that might affect his interest. Luckily it happens that this is very nearly about the average temperature that a building, so well secured as this is from the external air, would naturally bear at all seasons of the year in this climate, were it not to be affected by external objects. But as the heat of the milk, if it were in considerable quantities, would tend in summer to affect the temperature of the air, there is no impossibility but it might thus be raised on some occasions to a higher degree than was proper. It was to have at all times at hand an easy cure for this disorder that I wished to call in the assistance of the ice-house, as a small quantity of ice, brought into the milk-house at any time, would quickly moderate the heat to a proper degree. In the two small chambers adjoining to the ice-house too, or in the passages around the ice-house, the butter would be kept even cooler than in the milk-house itself. Other advantages that would arise from this small additional building will appear obvious.

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In winter, should the cold ever become too great, it might be occasionally dispelled, either by placing a barrel full of hot water, close bunged up, upon the table, where it might be allowed to remain till it cooled—or some hot bricks might be employed for the purpose. This I should prefer to any kind of chaffing-dish, with burning embers in it, as the vapour from the coals (which very soon affects the taste of the milk)* would thus be avoided.

The next object that demands attention is, the utensils of the dairy. These in general must, from the nature of the business, be made of wood. But of late many persons, who affect a superior degree of elegance and neatness, have employed vessels made of lead, or of common earthen-ware, for various purposes in the dairy. But, as the acid of milk very readily dissolves lead, brass, or copper, and with these forms a compound of a poisonous nature; such vessels must be accounted highly pernicious in the dairy, and therefore ought to be banished from it. The same may be said of vessels of any of the common kinds of earthen ware, which being glazed with lead, and the glazing soluble in acid, are equally

* Where a house is not well accommodated with *cellars*, it is sufficiently obvious that they might be built upon the same plan, and thus at a small expence might be reared, cellars that would be, in every respect, as good as the best vaults sunk deep under ground.

improper. Mr. HAYES has recommended cast-iron as a proper substitute for these; but this metal also is soluble in acids; and though the solution be not poisonous like the others, yet, as it may affect the taste of the products of the dairy, and render their medical qualities different from what they would naturally have been, the use of these also should be laid aside. In short, excepting vessels of true porcelain, or glass, which are greatly too expensive, I know of none that could be with propriety substituted for wooden vessels, in the dairy. China or glass vessels, however, for obvious reasons, can never come into general use in the dairy; nor will the sensible husbandman ever think of any other than wooden dishes for his milk; as these, if properly managed, can be kept as sweet and pure as the imagination can conceive. This fact is so generally known as to render wooden dairy utensils common in most parts of the country, so as that they can be readily procured every where of a proper quality, and form of construction, and therefore nothing more on this subject need be here said.

The creaming dishes (so I call the vessels in which the milk is placed for throwing up cream) when properly cleaned, sweet, and *cool*, are to be filled with the milk as soon after it is drawn from the

COW

cow as possible, having been first strained carefully through a close strainer, formed of a large wooden bowl with a hole at the bottom covered with a very close sieve of fine wire, (silver wire is best) or hair web woven for that purpose; or thin cloth of any kind, (I should always prefer the wire, as most durable and cleanly) so as to keep back hairs, &c. that may accidentally fall from the cow. These dishes should never exceed three inches in depth, whatever be their other dimensions; and if the plan recommended above of separating the milk into two parts, and of keeping each cow's milk by itself, shall be followed, it would be convenient to have them made of such dimensions as to contain about one and a half or two gallons English. As soon as they are filled they are to be placed on the shelves in the milk-house, where they should be allowed to remain perfectly undisturbed till it be judged expedient to separate the cream from them.

The length of time that should elapse before the cream be separated, will depend upon the degree of heat at the time, and the particular views of the owner of the dairy. In a moderately warm temperature of the air, if very fine butter be intended, it should not be allowed to stand more than six or eight hours. For ordinary good butter it may safely be let stand twelve hours, or more; but where the

dairy is so large as to afford a sufficient quantity of cream, and where the very best butter is intended, (the milk being to be converted to some other use while yet sweet) it may be separated after standing only two, three, or four hours.

When the cream is to be separated, the milk-pan should be taken from the shelf, and placed on the table. The cream is then to be separated from the edges of the vessel, to which it firmly adheres, by means of a knife with a blunt edge provided for that purpose, (the blade formed either of *pure* silver or of fine ivory) which should be made to run round the edges of the whole. The cream is then to be carefully drawn towards one side by means of a skimming-dish, and then lifted up with great nicety so as to take the whole without any of the milk, if possible. This requires a dexterity of manipulation* that can be acquired by practice alone; but it is of great importance to the success of the dairy that it be well done, for if any part of the cream be left, the *quantity* of butter will be diminished, and if any part of the milk be taken, its quality will be debased. The wooden skimming-dishes commonly employed, seem not to be so

* This may be accounted a cramp word, but it expresses the idea intended so much better than *operation* or *process*, or any other word in common use, that I could not think of rejecting it; and hope it will soon come to be as generally used as any other word in the language.

handy for this purpose as could be wished. An improvement on this apparatus might be suggested, but this I decline at present to enlarge upon.

When the cream is thus obtained, it ought to be immediately put into a vessel by itself, there to be kept till a proper quantity be collected for being made into butter: and no vessel can be better adapted for that purpose than a firm neat-made wooden barrel, in size proportioned to the extent of the dairy, open at one end, with a lid exactly fitted to close it. In the under part of this vessel, close to the bottom, should be placed a cock or spigot, for drawing off from time to time any thin serous part of the milk that may chance to be there generated; for should this be allowed to remain, it acts upon the cream in a powerful manner, and greatly diminishes the richness of the quality of the butter. The inside of the opening of the barrel should be covered with a bit of close fine wire (silver) gauze netting to keep back the cream; while the serum is allowed to pass; and the barrel on its stand should be inclined a little forward in the top to allow the whole to run off.

Many persons who have had little experience in the dairy believe, that no butter can be of the finest quality, except that which has been made from
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cream that has not been kept above one day; but this is a very great mistake. So far indeed is this opinion from being well founded, that it is in very few cases that even tolerably good butter can be obtained from cream that is not more than one day old. The separation of butter from cream only takes place after the cream has attained a certain degree of acidity. If it be agitated before that acidity has begun to take place, no butter can be obtained, and the agitation must be continued till the time that that sourness is produced, after which the butter begins to form. In summer, while the climate is warm, the beating may be, without very much difficulty, continued until the acidity be produced, so that butter may be got; but in this case the process is long and tedious, and the butter is, for the most part, of a soft consistence, and tough and gluey to the touch. If this process be attempted during the cold weather in winter, butter can scarcely be in any way obtained, unless by the application of some great degree of heat, which sometimes assists in producing a very inferior kind of butter, that is white, hard and brittle, with very little taste, and almost unfit for any culinary purpose whatever.

The judicious farmer, therefore, will not attempt to imitate this practice, but will allow his cream to remain

remain in the vessel appropriated for keeping it, until it has acquired that proper degree of acidity that fits it for being made into butter with great ease, by a very moderate degree of agitation, and by which process only very fine butter ever can be obtained.

How long cream ought to be kept before it attains the precise degree of acidity that is necessary to form the very best butter, and how long it may be kept after that period before its quality be sensibly diminished, has never yet, I presume, been ascertained by any experiments that can be relied on. So little nicety has been observed in this respect by practical farmers, even those who have a high reputation for making good butter, that few of them ever think of observing any precise rule in this respect with regard to the different portions of their cream, seeing they in general make into butter all the cream they have collected since the former churning, so that the new and the old is all beaten up together; and I can find nothing like a uniform rule established among them as to the time that should intervene between one churning and another, that being usually determined by local or accidental circumstances. I am, myself, inclined to believe, that if the cream be carefully kept, and no ferrous matter allowed to lodge about it, a very great latitude

tude may safely be admitted in this respect. How long cream may be thus kept in our climate, without rendering the butter made from it of a bad quality, I cannot say; but I can say with certainty, that it may be kept good for a much longer time than is in general suspected, even a great many weeks. It is however certain, that cream, which has been kept three or four days in summer, is in excellent condition for being made into butter; and I am inclined to believe, that from three days to seven may be found in general to be the best time for keeping cream before churning; though, if circumstances make it necessary, a considerable latitude in this respect may be allowed.

If, however, it should chance that any farmer has such a quantity of cream as might be worth his while to churn once every day, there is nothing to prevent him from doing it. He has only to provide a separate vessel for holding the cream for each day he means it should stand before churning; if three days, three vessels; if four days, four vessels; and so on. Thus he might churn every day cream of three days old, or of four, or any other number of days old, that he might incline. In the same manner, if it were found that the cream of two, of three, or of a greater number of days gathering, was required to make a proper churning, it might
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be easy so to contrive it as to churn every day, as will be obvious to any one who shall think upon the subject. In this way the operations of a dairy may be kept perfectly regular and easy.*

The vessel in which butter is made, usually called a *churn*, admits, in the form of it, a considerable diversity. The simplest that I have seen I should prefer as the best, merely because it admits of being better cleaned, and of having the butter more easily separated from the milk, than any of the others; this is the old-fashioned upright churn, having a long handle with a foot to it perforated with holes, for the purpose of beating the cream, by being moved upward and downward by hand. But though, for the reasons assigned, I should prefer that form of a churn, other persons may choose that which they like best, as all the sorts, under skilful management, will perform the business perfectly well. Indeed, if the cream be prepared as above directed, the process of churning will be so easy, as to render those utensils in general the most commodious which can be most easily filled and emptied.

* Some persons choose to churn the whole of the milk without separating any part of the cream. In this way they obtain a greater quantity of butter, though of an inferior quality. By careful management, however, especially if a portion of the first-drawn milk be separated, very good butter may be obtained; but I think the practice, on many accounts, is not to be recommended.

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In the process of churning much greater nicety is required than most persons seem to be aware of. A few hasty irregular strokes may render the whole of the butter of scarcely any value, that, but for this circumstance, would have been of the finest quality. The owner of an extensive dairy, therefore, should be extremely attentive to this circumstance, and should be at great pains to procure a proper person for managing this branch of business. This person ought to be of a cool phlegmatick temper, sedate disposition and character, and ought never to allow another person, especially those who are young, to touch the churn, without the greatest caution and circumspection. Those who have been used to see cream churned that has not been properly prepared, will think, perhaps, that this would be severe labour in a large dairy for one person; but nothing is more easy, as to the bodily labour it requires, than the process of butter-making, where the cream has been duly prepared.

The butter when made must be immediately separated from the milk, and being put into a clean dish, (the most convenient shape is that of a shallow bowl) the inside of which, if of wood, should be well rubbed with common salt, to prevent the butter from adhering to it; the butter should be pressed and worked with a flat wooden ladle, or skimming
dish,

dish, having a short handle, so as to force out all the milk that was lodged in the cavities of the mass. A considerable degree of strength, as well as of dexterity, is required in this manipulation. The thing wanted is to force out the milk entirely, with as little tawing of the butter as possible; for if the milk be not entirely taken away, the butter will infallibly spoil in a short time, and if it be much worked, the butter will become tough and gluey, which greatly debases its quality. This butter is in some places beaten up by the hand, which I consider as an indelicate and barbarous practice.

Some persons employ cold water in this operation, which they pour upon the butter, and thus, as they say, wash it; but this practice is not only useless, as the butter can be perfectly cleared of the milk without it, but also pernicious, because the quality of the butter is thus debased in an astonishing degree. Nothing is so hurtful in a dairy as water improperly used, which, if mixed in any way with either milk or butter, tends greatly to debase the quality of the last.

When the butter is entirely freed from the milk, if it is to be sold sweet, it may be made up into any form that is most generally liked at the market where it is to be sold. If the heat should be so great as to render it too soft to receive the impression
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of the mould, it may be put into small vessels, which may be allowed to swim in the trough of cold water under the table, but without allowing any of that water to touch the butter;* there it will in a short time acquire the necessary degree of firmness, (especially if a little bit of ice shall have been put into the basin) after which it may be taken out and moulded into proper form. It should then be put down, in proper dishes, upon the stone border that surrounds the trough, where it may be kept cool and firm till it be packed up to go to market.

In every part of the foregoing process it is of the utmost importance that the vessels, and every thing else about the dairy, be kept perfectly clean and sweet, for without this precaution there neither can be pleasure nor profit derived from it. This is a circumstance so universally admitted, that it may seem superfluous to take notice of it in this place. Yet though this be generally known and admitted, and though every person who attempts to manage a dairy of any sort may intend to have things clean

* The practice that prevails in many private families of keeping the sweet butter among water in a crystal vessel, and thus serving it up to table, is for the same reason much to be censured. If coolness only is wanted, it were better to put the butter in a dry glass, and put that into a larger one among water. If it were taken out of that immediately before it were put upon the table, it would always have firmness enough in our climate.

and proper, they may nevertheless be, in some cases, at a loss for the proper way of effecting their intentions, or of guarding against certain evils, which, if once allowed to take place in the dairy, will not be easily removed. Some hints, therefore, are subjoined in a note that may be of service to those who are not well acquainted with this department of business.*

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* As soon as the cream is separated from the milk, the dishes should be carried out of the milk-house, and immediately emptied, and the skimmed milk applied to the uses that the owner of the dairy judges to be most advantageous to him. As soon after the dishes are emptied as possible, they must be well washed with scalding hot water, which should be kept in readiness for that purpose; and as the naked hand cannot be put among the scalding water, a scrubbing-brush of a proper construction must be kept in readiness for that use. This may be made of a bunch of wire, firmly bound up with strong packthread, where other materials cannot be had; but the stumps of an old heath-besom, after the small twigs have been worn off, firmly bound together, are found to answer this purpose remarkably well, nor ought any thing else to be sought for where that can be had, for this is both firm and tough, so as to stand the work extremely well.

After the dishes have been thus perfectly scalded, and thoroughly scrubbed in every part, they must be carefully rinsed with blood-warm water, and well scoured by hand with a coarse linen cloth. They are then to be turned down one by one as they are finished bottom upwards, upon a clean shelving board to drip. When the whole are gone over in this way, the dairy-maid returns to the first done, and with a dry cloth wipes them one by one as clean as possible. They are then placed in ranges, so as to be exposed fully to the action of the sun and air on the inside, that the whole of the moisture may be dried up as quickly as may be; for nothing tends so soon to destroy the sweetness that is so desirable in dairy vessels as for the moisture to be allowed to remain long about them. Therefore, in dull foggy weather, when this cannot
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On some occasions a part, or the whole, of the butter may, perhaps, be disposed of fresh; but in general

be quickly dried up by the external air, it is necessary to do it by the aid of fire in the house. As soon as the dishes are thoroughly dried, they must be carried into the shade, and placed in order on shelves to cool, to be in readiness for use when they shall be again wanted.

But should the milk have been suffered at any time to remain so long in the dish as to become sour, the wood instantly becomes tainted with that acidity, so as to act as a leaven upon any milk that shall be afterwards put into it, which never fails to coagulate without separating any cream, and can neither be employed in making butter nor cheese, and is consequently lost in the dairy. The scalding above described is by no means sufficient to remove this destructive taint; and as the dishes are totally useless till that be removed, the following more efficacious process must be adopted:—

Fill the vessel with water scalding hot, and into that put a considerable quantity of hot ashes, and small red embers from the fire. Stir it about frequently, scrubbing it well in every part with the scrubber. Let this remain a considerable time; then empty the dish, scrub it as usual with scalding hot water, rinsing it well with hot, and then with cold water. Then fill it to the brim with cold water, better if that water can be made to run into it in a continued stream, and flow over the brim; let it stand in this state ten or twelve hours or more, after which wipe and dry it, and if the taint has not been very strong, it will then be fit for use.

If the ashes of your fire should chance to contain very little salt, this operation may perhaps not prove effectual. In that case add a small proportion of potashes along with the embers, &c. or quick-lime may be employed along with the potashes, which greatly adds to their cleansing power. But in all cases where recourse is had to this process, take great care that the dishes be well cleaned by the rubber at each time; and that cold water be allowed to stand a considerable time in them,

general it must be salted before it can be carried to market. And as this part of the process requires as great nicety as any other, a few remarks on the subject shall be added.

Wooden vessels are, upon the whole, most proper to be employed for containing salted butter. These should be made of cooper work, very firm, and tightly joined with strong *wooden* hoops. It will be adviseable to make them very strong where circumstances permit them to be returned to the dairy; for as it is a matter of considerable difficulty to season new vessels so well as that they shall not affect the taste of the butter, it is always adviseable to employ the old vessels rather than make new ones, as long as they continue firm and sound. Oak is the best wood for the bottom, and staves and broad Dutch split hoops are to be preferred to all others, where they can be had. Iron hoops should be rejected, as the rust from them will in time sink through the wood, though it be very thick, and

them, which should be frequently changed, that the whole of the salts may be extracted by it before they be used again.

The dishes for holding the cream, and the churn, require to be scalded, scrubbed, rinsed, and dried, after each time they are used, in the same manner as the milk dishes; but, as a sour taint is not here so prejudicial, it is not necessary to guard so carefully against it as in the milk dishes. But if ever this taint should become too strong, it may be diminished by the process above described.

injure

injure the colour of the butter: one iron hoop, however, should be put at the top, and another below beyond the bottom, the projection below the bottom being made deep for this purpose. No form is more convenient than that of a barrel, unless, perhaps, it be that of a truncated cone, with the apex uppermost; as in this case the butter never can rise from the bottom, and float upon the brine, which it will sometimes do in the under part of a barrel when brine is necessary. But this inconvenience may be easily obviated, by driving a wooden peg with any kind of a head into the bottom before it be filled, as the butter closely embracing that head all round, will be kept perfectly firm in its place.

An old vessel may be prepared for again receiving butter, by the ordinary process of scalding, rinsing, and drying; but to season a new vessel requires greater care. This is to be done by filling it frequently with scalding water, allowing it to remain till it slowly cools. If hay, or other sweet vegetables, are put into it along with the water, it is sometimes thought to facilitate the process. But in all cases frequent affusions of hot water are very necessary, and a considerable time is required before they can be rendered fit for use. The careful *dai* ought to be particularly guarded with respect to
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this particular, or he may soon lose his character at market.

After the butter has been beaten up and cleared from the milk, as before directed, it is ready for being salted. Let the vessel into which it is to be put, after being rendered as clean and sweet as possible, be rubbed all over in the inside with common salt, and let a little melted butter be run into the cavity between the bottom and the sides at their joining all round, so as to fill it and make it every where flush with the bottom and sides. It is then fit to receive the butter.

Common salt is almost the only substance that has been hitherto employed for the purpose of preserving butter; but I have found, by experience, that the following composition is, in many respects, preferable to it, as it not only preserves the butter more effectually from any taint of rancidity, but makes it also look better, and taste sweeter, richer, and more marrowy, than if the same butter had been cured with common salt alone. I have frequently made comparative trials with the same butter, and always found the difference much greater than could be well conceived. The composition is as follows:

Vol. V.

I

Take

Take of sugar one part, of nitre one part, and of the best Spanish great salt, (or of Doctor Swediaur's best salt,* which is still better than the former, being cleaner) two parts. Beat the whole into a fine powder, mix them well together, and put them by for use.

Of this composition one ounce should be put to every sixteen ounces of butter; † mix this salt thoroughly

* Dr. Swediaur carries on a manufacture of salt at Prestonpans near Edinburgh, after the Dutch method; this the Dutch sell by the name of salt upon salt; it is equally strong with the best Spanish salt, and much freer from impurities of every sort, and the Doctor sells it at a moderate price. Were this salt sufficiently known to be brought into general use for curing fish, butter, beef, pork, bacon, hams, tongues, and other articles of provision, it would much promote the prosperity of this country, as these could be as well cured by it as with foreign salt, and at a much smaller expence.

† It is of great consequence that every process, which requires much thought or nicety, should be banished, if possible, from all branches of manufacture. On this principle, as some difficulty might arise in proportioning the quantity of salt to unequal weights of butter, I should advise that every person who means to adopt this practice at large should begin with providing himself with a steelyard so constructed as that sixteen ounces in the one scale is exactly balanced by one in the other. And that he may be at no loss to provide himself with this simple apparatus, the following directions may be attended to:

Let him provide two scales of equal weight; one of them should be of wood, and flat for the butter, no matter what form or materials the other is of; let him then take a slip of deal two inches broad, half

thoroughly with the butter as soon as it has been freed from the milk, and put it without loss of time down into the vessel prepared to receive it, pressing it so close as to leave no air-holes, or any kind of cavities within it. Smooth the surface, and if you expect that it will be above a day or two before you can add more, cover it close up with a piece of clean linen, and above that a piece of wetted parchment, or for want of that, fine linen that has been

an inch thick, and two feet long. Near to each end, and at about half an inch from the same side at each end, make a hole through the board, to which the scales may be fastened by means of a loop of wire; observe, that these two holes should be placed exactly at the same distance from the edge. Let him then load the two scales, one of them with one ounce, and the other with sixteen, and having drawn a line parallel to what will now appear to be the upper side of the beam, at half an inch from the top all along on each side, let him be provided with two sharp-pointed instruments, such as a shoemaker's awl: Let him then try to find a point in the new-made line on each side of the beam, where, when the beam is allowed to vibrate on his awls placed directly opposite to each other, the two weights balance each other. This point he will soon discover to be much nearer one of the ends of the beam than the other. Through this point let him pierce a hole by means of a round hot iron. Through this hole put a piece of thick iron wire, which if supported at each end will serve as a pivot. The apparatus is now complete.

And whenever it is afterwards wanted, nothing more is necessary than to place the butter, whatever be its weight, into the butter-scale, and then put as much of the composition into the opposite scale as brings the beam to a balance: and this will in all cases be the due proportion of salt for the butter, whatever the weight of that butter may be.

dipped in melted butter, that is exactly fitted to the edges of the vessel all round, so as to exclude the air as much as possible, without the assistance of any watery brine; when more butter is to be added, these coverings are to be taken off, and the butter applied close above the former, pressing it down and smoothing it as before, and so on till the vessel be full. When it is quite full, let the two covers be spread over it with the greatest care, and let a little melted butter be poured all round the edges, so as to fill up every cranny, and effectually exclude the air. A little salt may be then strewed over the whole, and the cover be firmly fixed down to remain close shut till it be opened for use. If all this be carefully done, the butter may be kept perfectly sound in this climate for many years. How many years I cannot tell; but I have seen it two years old, and in every respect as sweet and sound as when it was only a month old.

It deserves to be remarked, that butter cured in this manner does not taste well till it has stood at least a fortnight after being salted; but after that period is elapsed, it eats with a rich marrowy taste, that no other butter ever acquires; and it tastes so little salt, that a person who had been accustomed to eat butter cured with common salt only, would

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not imagine it had got one fourth part of the salt that would be necessary to preserve it.*

Butter thus cured would bear to be carried to the East or the West-Indies, and would keep sweet during the longest voyages, if it were so packed as not to allow the butter to be so far melted as to occasion the salts to separate from it. But as none of these salts admit of any chemical union with the butter, it must happen, that if ever the butter be so far melted as to become of a fluid consistence, the

* But after this butter has been cured in the most perfect manner, it may chance to be much debased in its quality by being improperly treated during the time it is using. Therefore, observe, that, when it is broken up for use, a small portion should be pared from the surface all over, especially near the edges, in case the air should not have been so entirely excluded as it ought to have been. If it be to be quickly consumed, it may be then spooned up as it is wanted, without any other precaution than that of keeping it carefully covered up so as to exclude dust, &c. from having access to it. But if it be to be used very slowly, and if the person to be employed in spooning it up be not very careful, or so indolent as not to be at the trouble of closing it up at each time with the covers, it may happen that the part which is thus long exposed to the air may contract a small degree of rancidity. To guard against this evil, in these circumstances, when the vessel is opened, let a strong brine of common salt be prepared that will swim an egg, and poured, when cold, upon the surface of the butter; this will cover that surface effectually, even though the operator should be a little careless, and will thus guard against the inconvenience complained of: for though the quality of the butter will thus be injured in some degree, in consequence of the water acting upon it, yet that is an evil of far less material moment than the slightest degree of rancidity would occasion.

salts drop to the bottom, and the butter, deprived of their antiseptick powers, quickly becomes rancid. It would be a great improvement in the culinary art, if any antiseptick substance could be found that possessed any agreeable taste and flavour, which was capable of being dissolved in oily substances. This might afford a proper subject for a premium by the Bath Society. In the mean time the following hints on this subject may be of some use.

Butter, in its natural state, contains a considerable proportion of mucous matter, which is more highly putrescible than the pure oily parts of the butter. Where it is, therefore, intended that butter should be exposed to the heat of warm climates, it ought to be freed from that mucilage before it be cured and packed for keeping. To prepare butter for a distant voyage, therefore, in warm climates, let it be put into a vessel of a proper shape, which should be immersed into another containing water. Let the water be gradually heated till the butter be thoroughly melted; let it continue in that state for some time, and allow it to settle; the mucous part will fall entirely to the bottom, and the pure oil will swim at top, perfectly transparent while hot, but when it cools it becomes opaque, assumes a colour somewhat paler than the original butter before it was melted, and a firmer consistence, more nearly re-

sembling

sembling that of tallow, and consequently it will better resist the heat of a warm climate than butter itself. When this refined butter is become a little stiff, and while it still is somewhat soft, the pure part should be separated from the dregs, and then salted, and packed up in the same way as is directed for butter. This would retain the salt longer, and keep much longer sweet in hot climates, than if it had been cured in its original state.

This refined butter may be preserved in yet another way, which I have sometimes seen practised here by way of medical *bonne bouche* (comfit.) After the butter is purified, add to it a certain proportion of firm honey, mix it well, it will incorporate thoroughly with the butter, and when cold it eats very pleasantly spread on bread like butter; and may be given to old people, if they relish it, instead of marrow, and to others, as being useful for coughs and colds. These were the uses to which I have seen this substance applied, and on these occasions the proportion of honey employed was considerable. I have seen it kept for years, without manifesting the smallest tendency to rancidity, so that there can be no doubt but that butter might thus be preserved in long voyages without spoiling. The only point that remains to be ascertained is, what is the smallest proportion of honey that would be sufficient to
 preserve

preserve the butter. Sugar is known to be a much more powerful antiseptic than common salt, and probably honey may be in that respect nearly on a par with sugar. If so, it would be reasonable to suppose that one ounce of honey might be sufficient to preserve sixteen ounces of butter. In that case the taste of the honey would not be extremely perceptible, so that the butter, even to those who might not relish the sweet composition above-mentioned, might prove very agreeable, especially if a little salt were mixed with it when about to be used. A few experiments would be sufficient to ascertain this particular.

From the circumstance of the honey incorporating with the butter, and not separating from it while in a fluid state, it would promise nearly to accomplish the purpose wanted above. Whether, when it became very fluid, and was long continued in that state, any separation would take place; or whether the honey in these circumstances would be in danger of fermenting; are questions that experience alone can determine. Sugar, though it would preserve the butter equally well while it continued in a solid state, would doubtless separate from it when it became fluid. Whether melasses would do so, or what effects they would in this case produce, I cannot tell; but a few experiments would ascertain

tain

tain these points. Should any method of preserving butter in warm climates be discovered, it would be productive of so many benefits to individuals, and to the nation at large, by giving an opening for a new branch of commerce and manufacture, that it is much to be wished the few experiments wanted to ascertain these points were made with such care, under the direction of persons who would faithfully report the result to the public, as should be sufficient to remove all doubts upon this head.

P. S. The greatest part of the observations contained in the foregoing pages were derived from a Lady, who is now beyond the reach of being affected by any thing in this sublunary world. Her beneficence of disposition induced her never to overlook any fact or circumstance that fell within the sphere of her observation, which promised to be in any respect beneficial to her fellow-creatures. To her gentle influence the publick are indebted, if they be indeed indebted at all, for whatever useful hints may at any time have dropt from my pen. A being, she thought, who must depend so much as man does, on the assistance of others, owes as a debt to his fellow-creatures the communication of the little useful knowledge that chance may have thrown in his way. Such has been my constant
aim;

aim: such were the views of the wife of my bosom—the friend of my heart, who supported and assisted me in all my pursuits. I now feel a melancholy satisfaction in contemplating those objects she once delighted to elucidate.

ARTICLE V.

Of the Scotch Fir, as a Food for Cattle.

[By the Same.]

IT is not in general known that any of our ever-green shrubs or trees, except the *whins*, [furze] can be employed as a provender for cattle; but probably many more of these could be successfully employed for that purpose than is in general suspected.

Cattle and sheep are known to crop the tops of fir-trees when they can get access to them while young; and thus many plantations of young trees, when not sufficiently fenced, have been entirely destroyed; but whether that kind of food was wholesome or pernicious to the cattle, has not in general been enquired into.

We have indeed heard long ago, that in Norway the cattle are often fed in winter upon the tender
twigs

twigs of young fir-trees; but as we are at the same time told that for want of other food, they are sometimes forced to subsist upon dried fish-bones beat small, this had the appearance of being the consequence of extreme necessity alone. It has been found, however, on some trials that have been made in the North of Scotland, that the tender twigs of the Scotch fir afford a wholesome food for cattle, that may be occasionally employed for that purpose without danger, in case of a scarcity of other provender.

The first notice I had of this particular was in a letter from the bailiff of a gentleman of considerable eminence in —shire, dated the 25th of October, 1782, which runs thus: “ I was so pinched last
 “ spring for provender to cattle, that I had not a
 “ stone of straw, or a stone of hay, from the middle
 “ of March; nothing but whins and oats for horses,
 “ and fir-tops (that is, tender shoots of firs) for
 “ cattle; and I had 430 horned cattle, and about
 “ 120 horses small and great, of which I lost but
 “ few (four or five, I cannot tell which) cattle, but
 “ there were numbers of cattle that died in this
 “ country for want. Some tenants lost the one-
 “ half of their cattle, and some almost the whole.”

It deserves to be noted, that the spring of 1782 was so backward, that in the country here alluded to, it was near the middle of June before the grass was sufficiently up to support the cattle, so that they had been kept near three months entirely upon this kind of food,—a sufficient trial of its wholesomeness. It deserves further to be remarked, that in Highland countries, where great numbers of young cattle are reared, there never is a winter that some of them do not die, however plentiful the provender is. In the present case, it is probable, the death of the few that were lost might be occasioned by the weakness of the young beasts, produced by pinching them of food before the provender was done, rather than to the influence of the new food they were put upon.

I was afterwards told, upon enquiry, that in this case the cattle were kept in the house, and the twigs of the trees carried to them and given them in their stalls; but I afterwards learnt that the same season, another gentleman, who knew nothing of this experiment, adopted a method that seemed to me to be more simple and æconomical, and easier carried into practice on a larger scale than the above.

Having foreseen that he should be scarce of provender, he turned out all his stock of two years old cattle

cattle into a young fir wood that was near his house, in the beginning of winter, and allowed them to pick up what little grafs they could there find, till he saw it was all consumed. He then sent a man into the wood every morning to cut down from the trees as many branches as would subsist them for that day. These were allowed to fall among the trees at random. The cattle soon became accustomed to this food, and ran to the place where the man was, as soon as they heard the noise. They ate not only the leaves and smallest twigs, but they even sometimes gnawed down the stumps till they came to be nearly the bigness of the thumb. In this way they continued all winter, in perfect health.

From these facts, and others of a similar kind that have since then come to my knowledge, there can be no doubt but that the twigs of firs may, in times of scarcity of fodder, be employed with success in preserving cattle from the danger of perishing from want. It is not, at present, by any person suspected that this feeding would fatten any of them; it is only recommended as being sufficient to preserve them alive, and in good health, when other food fails. To persons who live in a corn country, where provender is always plenty, and the stock of cattle small, this will appear a matter of trivial importance: but in hilly breeding countries, where
grain

grain is scarce, and the stock of cattle very great, it will be viewed as of the highest importance, as will appear from the letter above quoted. There is no country, especially of the barren sort, in which a plantation of fir-trees may not be easily reared; and in this case it would always be a ready source of plenty, to which recourse need not be had until a general scarcity should make it necessary.

It is also well known that sheep eat this food very greedily, and that it never hurts them; and as these valuable little animals are frequently prevented from reaching the grass by reason of snow, and the stock of hay provided for them sometimes fails so entirely as to occasion the total loss of many thousands at once, in extensive sheep countries, which might be altogether prevented by having a small plantation of firs on each farm, to be kept as a reserve of accessible food, to be used only when other resources failed; I cannot think any sensible man, in these circumstances, should delay one moment to set about forming this necessary inclosure upon every farm. I state facts; and leave those who have occasion for it to make the proper use of them.



ARTICLE VIII.

Of raising Potatoes from the Seed.

[By the Same.]

SINCE the paper on potatoes, which is printed in your former volume, was written, I have made several other experiments on the culture of that plant; but I only mean at present to correct one erroneous opinion I had adopted from the result of the *single* experiment I had then made with regard to the raising potatoes from seed. I at that time thought it probable that no new varieties could be thus obtained, and doubted whether a mongrel breed could thus be produced, like that which may be obtained at pleasure from different varieties of turnips, cabbages, &c. I am now, however, convinced, from an experiment that was conducted with greater care, that there are plants which do produce varieties from seeds, greatly different from the parent stock; that these varieties are not of the nature of mongrels, but are altogether distinct from any sorts that may have been known; and that the potatoe belongs to this class of plants.

With a view to ascertain these particulars, I made choice of a kind of potatoe that I had got from
Ireland,

Ireland, which was, in many of its most obvious characteristicks, extremely different from any that was cultivated in this neighbourhood. In particular its colour was remarkable, being a dark dirty purple; its shape a round irregular bulb; its stem tall and upright. This kind of potatoe was planted by itself, at as great a distance as I could place it from any other sort; but all the varieties that were around it were of the white sort, none of any other colour being cultivated in this neighbourhood.

The seeds of this sort, carefully separated from all others, were sown by themselves, and the seedlings planted out at a convenient distance from each other, when they had attained a proper size for being transplanted. It was soon, however, obvious, from the appearance of the stems, that they were not all of one sort; and on taking them up in autumn, I then discovered that the variety was almost infinite, and such as could not be accounted for on the principles of a mongrel adulteration. The diversities respected colour, shape, &c. a few of which particulars are specified below.

COLOUR. Dark purple, bright red pink, dark pink, other varieties of red, bright white, dun, yellow, black, dark greenish, spotted, and many other varieties.

SHAPE.

SHAPE. Round bumps, oblong, very long, kidney-shaped, irregularly knobbed, and many other sorts.

TIME of RIPENING. Very early, so as to have the stalks quite decayed in August; very late, so as to have the bulbs only beginning to be formed in the middle of October, and an infinite diversity between them.

STEMS. Tall and robust, weak and dwarfish, branching at the top, branching greatly from the root, quite upright, and naked as a staff, &c. &c.

MANNER of GROWTH. The bulbs adhering quite close to the stem in a cluster like a bunch of grapes; others rambling to a great distance from the stem, adhering to long fibres running wide in every direction, and intermediate diversities of many sorts.

SIZE of BULBS. Some large as a hen's egg, others very small, not much bigger than pease, and intermediate varieties.

PROLIFICACY. Some producing an immense number, as high as 140 at one stem, others affording few, as low as two or three only.

SKIN. Some smooth as silk, others rough like shagreen; some whole and uniform, others cracked in a variety of directions.

LEAF. Some broad and obtuse, others narrow, sharp and spur-shaped; some smooth, others rough; some comparatively glossy and shining, others uneven and much wrinkled, &c.

It would be endless to trace out all the other diversities. In short, the variety was greater than I could have conceived to be possible; and there was not perhaps two plants precisely of the same sort.

It is probable there will be found to be as great a diversity in the taste and other qualities, as in those particulars already remarked; but this I could not so readily ascertain.

From the above enumerations, it appears to me incontestibly evident, that the varieties can be in no sort ascribed to the influence of different varieties producing a compound between them, as in the mongrel breeds. There were many red, bright red, kinds of potatoes, though there was not one of that colour grew in the neighbourhood; and no mixture of white and dark purple could ever produce a bright red, or a dark bottle-green; not to
 mention

mention the diversities in other respects: therefore it cannot, I think, be denied that this experiment affords a clear demonstration, that there are plants which do not produce others of the same sort with themselves when reared from seeds, but varieties of the same class of plants, which may be diversified without end, the nature of which diversities cannot be foreknown.

Allow me, therefore, to add one more to the two classes of plants that were distinguished in my former paper; and we shall now have the following three classes of plants, viz.

1st. *Invariable*, viz. Those that always produce the same kind in every respect, with that of the seed sown; such as pease, beans, &c.

2d. *Permanent*. By which I mean those plants that may be propagated from seeds without change, as long as they are reared at a great distance from other varieties of the same plant, but which will be altered if suffered to grow near others of the same sort, producing with certainty an intermediate *mongrel* kind, participating of the nature of the sorts that grew near to each other, and nothing else; viz. Cabbages, turnips, beets, &c.

3d. *Sporting*, or those which always produce varieties from seeds without any known or apparent cause; as the potatoe, and many other plants.

There are probably other classes of plants that have not yet been observed or thought of.

It was to be observed, however, that though the variety of sorts was very great, yet the parent breed seems to have *some* influence on the progeny; as there were a greater number that in some sort resembled the parent stock than could be found of any other individual sort.

I shall not take up the time of the Society, by making many remarks on this experiment. It is enough that the fact be ascertained. Varieties may be obviously obtained from seeds; and some of these varieties may be found that shall possess valuable qualities that have not yet been found united in any single sort, though it is probable that for one truly valuable sort, many may be found which will not be nearly so well worth cultivating as those we already possess. These considerations, while it ought to induce those who have good opportunities for doing it, thus to raise new varieties each year, should also induce them to be particularly attentive to ascertain the qualities of each sort respectively,

with

with the most rigorous and cautious attention, so as not to allow themselves to be imposed on either by prejudice or prepossessions of any sort; for it is thus alone that useful sorts can be really obtained.

By attending to the facts above stated, it will also appear, that, in order to make a proper discrimination, the produce of each individual seedling plant ought to be cultivated entirely by itself, till its qualities be fully ascertained; and that none of the others be mixed with it, however much they may resemble it in appearance; as the qualities of these may be very different.

It would seem to me probable, that gentlemen, who have hitherto been in the practice of rearing seedling potatoes, have not been so strictly attentive to this last rule as seems to be necessary, and it is probably owing to this circumstance that we sometimes meet with particular stems of potatoes in a field, which, although resembling others in appearance, are extremely different from them in respect of prolificacy, and some other less obvious, though as important qualities. From this circumstance too, may have arisen many variations in the result of particular experiments on the culture of this plant, which seem to be altogether irreconcilable to each other.

Since those who conduct experiments of this sort, are thus so liable to be misled by unobserved particulars, so as to mark conclusions so different to each other; how cautious should they be not rashly to impeach the veracity of each other! Should two men, for example, take live potatoes from the same heap, seemingly alike in every respect, we see that their experiments, though conducted with equal care and accuracy, might give very different results.

ARTICLE IX.

Of Furze or Whins, [Ulex Uropæus, Linn.] as a Food for Horses and Cattle. Description of a Machine for bruising them, and Hints for rearing that Plant œconomically as a Crop.

[By the Same.]

I SHALL send for the Society a model of a machine for bruising *furze*, or as we usually call that plant in this country, *whins*, to render them a proper food for horses and cattle. This is an exact model of a machine I have employed for many years past, and have found to answer the purpose perfectly well. By the help of this machine, if the
whins

whins are good, one man, with an old horse not worth more than twenty or thirty shillings, may bruise as many whins as would keep forty head of beasts constantly eating that were fed on nothing else. This is independent of cutting and bringing home the whins, which in many cases will cost more upon the whole than the bruising.

The machine is so simple in all its parts, as to be readily understood by inspection only. It consists of a large circular stone set on its edge (the weightier and bigger the better) with a wooden axis passing through its centre. One end of this axis is fixed upon a pivot placed in the centre of a circular area, and to the other end of it is fixed a yoke, to which the horse that is to move it is attached. The stone being placed on its edge, when the horse moves, it revolves round its axis in a circular groove, or stone trough, (this trough should be made of hewn stone) exactly in the same manner as a sugar-baker's or a tanner's mill. The whins being placed in this trough are bruised by the weight of the stone as it passes over them, and being raised up by a three-pronged fork by the attendant, after they have been well flatted down, they rise in a sort of matted cake, which, being set in some measure upon its edge, is again smashed down by the wheel as it revolves around. In this way the operation

ration is continued, by successively presenting new surfaces to the action of the wheel, till the whole is reduced to a soft pulpy mass, that can easily be eaten by the animals to which it is to be presented.

During the continuance of this process, it is necessary to pour plenty of water upon the whins, at different times, without the help of which, they can scarcely be reduced to a pulp soft enough. On this account it will be proper to make choice of a place for the machine, where plenty of water can be obtained with little labour. It follows also, that as rain can never be prejudicial to this operation, it may properly be placed in the open air.

As this operation is greatly facilitated by a judicious way of raising or turning the whins, during the operation, which a little experience will enable any attentive person to attain, but which cannot be taught by words only; I would therefore advise any person who should think of erecting an apparatus of this sort, to put one of his most sagacious servants to conduct this operation at the beginning, as such a person will more quickly discover the circumstances that facilitate the process, than one of a slower comprehension would do. After he has become expert at the business, he will be able to instruct an inferior person, who may then be employed

ployed for the purpose. But in whatever way it shall be conducted, the person who begins this manufacture must lay his account with performing very little work for some time at the first, in comparison of what he will be able to execute afterwards with ease.

If the whins that are to be employed for this purpose grow naturally in the soil in irregular bushes, it is a troublesome work to cut and gather them. To understand the proper mode of managing this business in all its departments, it is necessary to advert to several particulars in the natural œconomy of this singular plant. Instead of leaves, the whin is furnished with an innumerable quantity of prickles. These spring out from every part of the young stem, and are, at the first, like the stem itself to which they adhere, succulent, soft, and inoffensive; but like the stems also, they become gradually harder, as the season advances, and seem, indeed, to a casual observer, to form a part of that stem, though they are as different from it as the leaves of other trees are from the branches which produce them.

These prickles do not, like the leaves of most deciduous trees, fall off at the approach of winter, but like evergreens, they remain upon the branches all winter, and retain during that time their full
succulence

fucculence and verdure. Early in the spring, innumerable blossoms spring out around these prickles adhering to them, and not to the stem. The blossoms are succeeded by pods containing the seeds, which gradually ripen; a little after Midsummer the seeds harden, and the pods slowly become dry and wither, the prickles to which they adhere becoming dry and withered at the same time, and gradually loosen from the stalk, which still continues fresh, though it has now attained a woody consistence. These prickles having now performed all the functions that nature had designed them, fall off in part, at first from the stalk, and in part adhere to it for some time, till they are gradually shaken off by the agitation of the wind, or other causes. Hence it happens that it is only the *surface* or top twigs of a whin bush that are green, soft, and succulent, the stems below being dry and woody, and frequently covered with dry prickles, that are not only not useful as food for cattle, but rather hurtful to them, on account of the hardness of their consistence, and sharpness of their prickles.

In gathering whins, therefore, for food for cattle, it is only the tender top shoots that are wanted, and the easiest method of gathering them that our practice has yet discovered, is to take a forked stick in the left hand (the readiest thing is the branch of a
tree

tree of a proper size) and a sickle in the right hand, (both hands, but more especially the right, should be armed with strong gloves) then thrusting the sickle among the young shoots, and pulling it backward, the forked stick when opposed to them keeps the branches steady enough to produce a resistance sufficient to make the sickle cut them; and as the tops of the whins are intermixed with each other, they stick to the prongs of the fork, which, after it is as full as it can hold, is taken to a side, and cleared by pressing the whins to the ground and pulling the fork backwards. These little heaps are afterwards forked to a cart, and pressed down by a man walking upon them, having his legs covered with large strong boots made on purpose, and thus are carried home.

If the whins have grown upon a good soil, and have made very vigorous shoots, they may be thus reaped pretty expeditiously; but if the soil has been poor, and the shoots short, the expence of this operation is very considerable; and as these short whins are, in other respects, of a very inferior quality to the others as food for beasts, it is only at times when fodder is scarce and dear, that they can be economically applied to this use.

To abridge this labour, and to obtain the full benefit of this valuable winter food, I tried myself to
cultivate

cultivate whins artificially, and have seen others rear them in several different ways, among which I found the two following modes of culture to prove the most successful:

In a field of a good dry loamy soil I sowed, along with a crop of barley, the seeds of the whin in the same way as clover is usually sown, allowing at the rate of from 15 to 30 pounds of seed to the acre. The seeds, if harrowed in and rolled with the barley, quickly spring up and advance under the shelter of the barley during the summer, and keep alive during the winter. Next season, if the field has not a great tendency to run to grass so as to choak them, they advance rapidly after Midsummer, so as to produce a pretty full crop before winter. This you may begin to cut *with the scythe* immediately after your clover fails, and continue to cut it as it is wanted during the whole of the winter; but it is supposed that after the month of February the taste of this plant alters, as it is in general believed, that after that time horses and cattle are no longer fond of it. I must however observe, that never having had myself a sufficiency of whins to serve longer than till towards the middle of February, or beginning of March, I cannot assert the above fact from my own experience. I have frequently seen horses beating the whins with their hoofs so as to bruise the prickles,
and

and then eat them, even in the months of April and May; and sheep which have been used to this food certainly pick off the blossoms and young pods at that season, and probably the prickles also; so that it is possible this opinion may only be a vulgar error.

Circumstances, which I need not here specify, have prevented me from ascertaining what is the weight of the crop that may be thus attained; but I think I may safely venture to say, that it is at least equal to that of a crop of green clover; and if it be considered that this affords a green succulent food during winter, on which cattle can be fatted as well as on cut grass in summer, it will I think be admitted, that it must be accounted even a more valuable crop than clover. After being cut it springs up the following season with greater vigour than before; and, in this situation, acquires a degree of health and succulence very different from what it is ever observed to possess in its natural state.* The prickles too are so soft, and the stems so tender, that very little bruising is necessary; indeed horses, who have been accustomed to this food, would eat it without any bruising at all: but cattle, whose mouths seem to be more tender, always require it to be well bruised.

* I have seen shoots of one season near four feet in length.

How long this crop might continue to be annually cut over, without wearing out, I cannot say; I believe a long while, in favourable circumstances; but I must now take notice of a peculiarity, that unless guarded against, will very soon extirpate it, as I myself experienced.

The natural progress of this plant has been described above with tolerable accuracy, but one particular was omitted. During the beginning of the season, nature seems to be solely employed about the great work of fructification only, and it is not till near Midsummer that the whin begins to push forth its wood-bearing branches, which advance with great luxuriance only during the latter part of the season. Hence it happens, that if care be not taken to have the grass that springs up on the field before the whin begins to send out its shoots eaten close down, that grass will acquire such a luxuriance before the young branches of the whin begin to advance, as to overtop them, and choak them entirely. Whoever therefore has a field under this particular crop, must be careful to advert to this circumstance, or, if the field be in good heart, he will infallibly lose it. The field therefore should be kept, as a pasture, bare as possible during the beginning of the season, and the cattle should only be taken from it when the shoots of the whin are discovered

covered to begin to advance with vigour. Under this management I presume it may be kept for many years, and yield full crops: but unless the mowers shall be particularly attentive, *at the beginning*, to cut it as low as possible, it will very soon become impossible to cut the field with a scythe, as the stumps will soon acquire so much strength as to break the scythe when it happens to touch them.

This is the best way I know of rearing whins as a crop for a winter food for cattle or horses. For sheep, who take to this food very kindly when they have once been accustomed to it, less nicety is required; for if the seeds be simply sown broad-cast very thin (about a pound of seed per acre) upon the poorest soils, after they come up the sheep of themselves will crop the plants, and soon bring them into round close bushes, as this animal nibbles off the prickles one by one very quickly, so as not to be hurt by them. Sheep, however, who have not been used to this mode of browsing, do not know how to proceed, and often will not taste them; but a few that have been used to this food, will soon teach all the rest how to use it.

Another very œconomical way of rearing whins that I have seen practised at large by another, rather than experienced it myself, is as follows:

Let

Let a farm be inclosed by means of a ditch all round, with a bank thrown up upon one side; and if stones can be had, let the face of that bank be lined with the stones from bottom to near the top; this lining to slope backward with an angle of about sixty or seventy degrees from the horizon. Any kind of stones, even round bullets gathered from the land, will answer the purpose very well: upon the top of the bank sow whin seeds pretty thick, and throw a few of them along the face of the bank. Young plants will quickly appear. Let them grow for two years, and then cut them down by means of a hedge-bill, stripping down by the face of the bank. This mode of cutting is very easy; and as the seeds soon insinuate themselves among the crannies of the stones, the whole face of the bank becomes a close hedge, whose shoots spring up with great luxuriance. If another ditch be made on the other side of the bank, and if this be managed in the same way, and if the hedge be cut down only once every second year, (and in this way it affords very good food for beasts) and the inside and the outside be cut down alternately, the fence will always continue good, as the hedge at the top will at all times be compleat. This mode of rearing whins is both convenient and œconomical. But where stones cannot be obtained for making the facing, the bank
 very

very soon moulders down, and becomes unfit for a fence.

I know few plants that deserve the attention of the farmer more than the whin. Horses are peculiarly fond of it. Some persons think they may be made to perform hard work upon it, without any feeding of grain; but I think it tends more to fatten a horse than to fit him for hard labour, and that therefore some grain should be given with it where the work is severe. Cattle eat it perfectly well when thoroughly bruised, and grow fat upon it as upon turnips; but unless it be very well bruised for them they will not eat it freely, and the farmer will be disappointed in his expectations. Cows that are fed upon it yield nearly as much milk as while upon grass, which is free from any bad taste; and the best winter-made butter I ever saw was obtained from the milk of a cow that was fed upon whins.

[We take this opportunity of publicly expressing our obligations to Dr. *Anderfon* for the model mentioned in the preceding essay, and which appears to be better adapted for the purpose than the stamping implements commonly used in Wales, and other parts. We have, from a motive of great respect to the opinion of our intelligent and worthy correspondent, inserted the essay at length, being confident that his practice of feeding cattle, &c. with young furze, so bruised, has not been adopted and continued without judgment. But we must at the same time beg his permission to

express our doubts, whether it can be advantageously introduced on so general a scale as he may apprehend. The soil, in which it should seem from experiment that the best crops of mowing furze are procured, we conceive may more advantageously be employed for the raising of corn; than which, and the intervening crops of green food that may be procured, particularly cabbages, we presume to think nothing can be of so substantial a value. Local situations and peculiarities may, however, furnish occasional exceptions to this general rule; and especially where land is comparatively cheap, and the article of fuel very dear, it may be of considerable advantage for the publick to be fully apprized of the best method of raising a crop, capable of being applied, as occasion may happen to render convenient, to either of two useful purposes—food or firing.

ARTICLE X.

Of the Root of Scarcity.

[By the Same.]

THE seeds I had from a common seed-shop, therefore it is *possible* they were not of the true sort; but the plants were so much like those of the true sort that have been described by others, that I think it is extremely *probable* they were genuine.

It is plainly a variety of the beet. The roots were of various colours, white, yellow, and red; the

the difference in the intensity of each of these tints was very great. The root is thick and fleshy, more resembling the beetrave, or red beet, than the common beet; the leaves large and succulent, also more resembling those of the green beet than the beetrave. The ribs of the leaves are always of the same tint with the root. The flesh of the root is coloured the same as the skin. Its taste a mawkish sweet, that is relished by very few of the persons who eat of it.

I sowed part of the seed on a light sandy soil, and part on a rich light loam. The plants on the last prospered much better than the other; it seemed to me that the sand was too poor a soil to rear this plant to its full size, though carrots, turnips, cabbages, and potatoes, were all reared upon it at the same time in the highest perfection. The seeds were sown about the beginning of April. This seemed to be too early, as many of the plants ran up to flower during the summer, which greatly diminished the crop, as they had been properly thinned before they began to run. Part of them were sown where they were to remain, and part of them were transplanted. Those that were not transplanted prospered the best.

During the summer the leaves were tolerably abundant, but nothing like so luxuriant as I had
 L 2 been

been made to expect. I caused some of the blades to be gathered, but this seemed rather to retard the growth of the root. Indeed the quantity that could be procured, did not seem to be, *at that season of the year*, worth the trouble of gathering. A much greater quantity of useful blades I think could be obtained from an equal extent of ground in cabbages. I am also inclined to think, that on the same soil, with an equal care in the culture, as great a weight of carrots or parsnips may be obtained; and I think there can be little doubt but a greater weight of turnips may be got; and that this last could be reared on many soils to great perfection where the root of scarcity could hardly be made to grow at all. I did not observe the smallest mark of any puncture from insects on its leaves, during the whole period of its growth. In this respect it seems to resemble the mulberry. Has Miss Rhodes tried if her silk-worms will eat it?*

It seems to be rather more hardy during the winter than most kinds of turnips, particularly its leaves, though they do not perfectly resist our winters: I even observed, that several of my plants were killed by the frost during this winter. Upon a careful examination of them, however, I think I

* This question being sent to the lady, she very obligingly made the experiment, but without success.

can observe that all those that have been killed, discovered some tendency to be about to shoot up into flower-stems towards the end of autumn.

I was anxious to know whether it continued late in the season before it began to run to seed in the spring, as I was in hopes that if it should be so, it would have some chance of proving a valuable addition to our catalogue of useful plants; but here also I have been disappointed. The season has been backward, and our turnips are only now (March 23d) beginning to shew their flower-stems. The root of scarcity is also fast advancing to the same stage of its growth, so that it will probably fail about the same time with the turnip crop.

The root is relished very well by cattle, and *my* horses eat it;* but I should fear it was of a nature

L 3

rather

* I find some persons who have offered this root to horses, which refused to eat it, entertain doubts if horses could ever be brought to eat it; but no one ought in a case of this kind to be deterred by a single trial. It often happens that a particular animal, or indeed many individuals, will refuse to eat a particular food they have not been accustomed to, which is well known to be both wholesome and palatable to that class of animals in general. I have seen many cattle that were, with great difficulty, brought to eat turnips, and some that never would take to that feeding kindly, so as to fatten upon it. I have also been informed, upon authority I could not doubt, that some sheep have actually died before they could be brought to taste that root. By a little attention, however, cattle may in general be brought to relish any

rather too succulent to be a very proper food for horses. I have no doubt but that cattle would thrive upon it very well, though the quantity I had was too small to enable me to speak experimentally to that point.

On the whole, though it is perhaps *possible*, that in certain circumstances this plant may be cultivated with profit; yet I should suspect, that if my seeds were of the genuine sort, it will not be found to be in general of equal value to the farmer as several plants with which we have been long acquainted. Independent of every other consideration, it appeared to me that the expence of taking up and cleaning this root, so as to make it fit to be given to the cattle, would be such as for ever to prevent it from coming into general use; for the fibres that spring out from it are so numerous and strong, as to entangle a great deal of earth among them, from which, if the earth has the smallest tendency to adhesiveness, it is a matter of great difficulty to disengage it. During wet weather in winter I do not

any succulent root of the nature of this in question, and horses also. My horses that are employed in taking turnips from the field in general learn in time of themselves to eat turnips, though horses in general do not take to this food at first. I saw a letter last year from a gentleman who had been at pains to train his horses to eat turnips, and he found it put them into good condition, and gave them a fine coat. He therefore thinks that young horses might be reared upon this root with advantage.

see how it would be possible to get this root taken up and made fit food for cattle at any thing like a bearable expence, especially that which has been transplanted.

ARTICLE XI.

Hints tending to point out the most practicable Means of improving the quality of BRITISH WOOL.

“ Mr. D'AUBENTON, foreseeing that in process of time the
 “ Spaniard might become wise enough to keep his fine wool at
 “ home and manufacture it himself, took his precautions to
 “ prevent the injury that this might occasion to the French
 “ woollen-drappers. He engaged government to import suc-
 “ cessively a great number of rams and ewes from Roussillon,
 “ Flanders, ENGLAND, Morocco, Spain, and even Tibet;
 “ and he assembled all these fathers and mothers of future flocks
 “ in his fold near Montbard, kept them for a whole year in the
 “ open air, night and day, and coupled them together by ex-
 “ perimental and well-contrived marriages.—Thus he ameli-
 “ orated considerably this branch of rural œconomy, and su-
 “ perfine cloths were made of wool of French growth.”

*Monthly Review, Dec. 1787. Mem. R. Acad.
 of Paris, Anno 1784.*

IT is in general admitted, that no species of ma-
 nufactures can be with so much certainty relied
 on, as a source of wealth and national prosperity, as
 those

those which are employed in working up the natural productions of the country where the manufacture is placed: hence it follows, that every wise state ought to bestow a particular attention to the improvement of such of its natural productions as are capable of being employed in working up manufactures of general utility, and for which an extensive demand may, at all times, be expected to take place.

It was probably on these principles our ancestors bestowed so much attention to improving the quality of British wool: and they so happily succeeded in this attempt as to rear wool in this island of a finer quality than could be found in any other European nation. This was the means of establishing those extensive woollen fabrics that have long been deemed the peculiar staple manufacture of this nation, which served as a firm basis for an extensive foreign trade.

Unfortunately, however, an idea began at length to prevail, that that pre-eminence which had been obtained in consequence of long-continued exertions of *industry*, was only a necessary consequence of physical causes. The peculiar fineness of our native wool was attributed entirely to the peculiarity of our climate, and delicacy of our pastures; and it

it was concluded, that so long as that climate should remain unchanged, and these pastures continue undeteriorated, our wool, without farther care, would continue to possess its wonted superiority. This idea was so warmly cherished as to influence, at length, the legislature itself. Measures were adopted that turned the attention of the farmer from the improvement of his wool. The consequence has been that, by slow degrees, and imperceptible changes, the quality of our wool has been greatly debased, and, from being the very *first* in Europe, it is now confessedly allowed to hold, at best, no more than the second place; as all our manufacturers concur in admitting that not a yard of superfine cloth can be made of any thing else than Spanish wool. It follows of course, that we must now depend upon a foreign country for the raw materials of the finest branch of our favourite staple manufacture. Thus have we unnecessarily subjected ourselves to all the inconveniences that must ever result from a dependant situation.

On the other hand, France, which, ever since the beginning of the administration of Mr. Colbert, hath made the most vigorous efforts to rival us in this important branch of manufacture, being now on an *equal* footing at least with ourselves in respect to the trade in Spanish wool, has so far succeeded

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as entirely to ruin our once flourishing traffick in fine cloths to the Levant; and bids fair for rivalling us in that article in other markets. But not contented with that single advantage, that politick nation, by having turned their attention for many years past towards the improving the quality of the wool of their own native produce, have at last, as appears by the authority referred to in the motto to this paper, under the auspices of the indefatigable Mr. D'Aubenton, been able to make superfine cloth entirely of their own wool, which was equal in beauty to that made of the best Spanish wool, and which, upon trial, was found to be superior to it in the wear.* These are facts which cannot be controverted, and they clearly prove, that if our superfine cloths are at present better than those of France, this superiority cannot be ascribed to the greater fineness of our own wool: they likewise shew, that if, in consequence of the absurd prepossession we have so long entertained concerning the magical qualities of British wool, we shall continue to neglect to attend to its improvement, while the French exert themselves in improving theirs; the time may at length arrive, when, in consequence of the gradual improvement in the quality of French wools, and the imperceptible decline of ours, the wool of

* See Memoirs of the Royal Academy of Sciences, ann. 1784 & 1785.

France may come to be not only equal in quality to that of Britain, but may even become as much superior to it, as British wool in former times exceeded that of France. To guard against this evil, I beg now to call the attention of my countrymen to this important object, and hope I shall be able to shew, in a very satisfactory manner, that if ever this revolution shall be permitted to take place, it must be owing to our own negligence alone; because, although it may not be impossible to improve the quality of French wool, yet it would be so much more easy to improve the quality of British wool, that if equal pains shall be taken in both countries, we cannot fail to leave them at an infinite distance behind. I shall farther, I hope, be able to prove, that by a very moderate effort, we could not only succeed in bringing British wool to regain once more its former superiority over that of Spain, but that it could be easily brought to a greater degree of fineness and excellence of quality than any wool that ever could be purchased for the purpose of manufactures in Europe: and that all this could be done, because of certain peculiarities respecting the nature of this island, which no other rival nation can boast of.

That the soil and climate of this island are naturally adapted to the production of fine wool, will
scarcely

disputed; the well-known fact that it produces the finest wool in Europe being a consequence of this circumstance; but that soil and climate alone are not sufficient to overrule the influence of all other circumstances, our own experience also too clearly proves. To be able to judge how far *nature* assists us in this enterprize, and in what respects it becomes necessary to call in the assistance of *art*, the two following facts ought to be very particularly adverted to.

1st. *Every filament of wool is greatly altered by the heat or the cold that the animal producing that wool is subjected to during the period of its growth; that part of the wool being always coarsest which is produced in warm weather, and finest in cold weather.** Hence it necessarily follows, that as wool continues to grow at every season of the year, that part of the filament which grows during the summer must be coarser than what grows during the winter season. If, therefore, the difference between the heat of summer and the cold of winter be very great in any place, it will be impossible there to rear good wool of a fine quality, because, however fine that part of it may be, which grows in winter, that part of it which is produced in summer must be very coarse.

* For proofs of this fact, see Observations on the means of exciting a Spirit of National Industry, Letter VI.

And

And as it is impossible, by sorting, in this case, to separate the coarse from the fine, the general staple of the wool can never be of the finest quality: but if the heat of summer, in the place where sheep are kept, does not greatly exceed the cold in winter, the wool produced in that climate will be nearly of an equal degree of fineness throughout the whole length of the filament, and therefore it will be, upon the whole, of a much finer quality than if the same wool had grown in a climate where the heat at one season was very great. But, it is well known, that on account of the insular situation of Britain, though our winters be not intensely cold, we never experience such a degree of heat in summer as takes place in France and other continental countries. In this respect, and in this respect alone, is Britain favoured by nature beyond other countries, in what regards the rearing of fine wool, *supposing they were equally in possession of the same breed of sheep.* And, when we advert, that, in some of the *northern* parts of this island especially, the winters are so moderate as seldom to deprive the flocks from reaching their food on account of snow; and the heat in summer so moderate as to be no more than sufficient to produce grass in abundance, without danger of parching it up; we shall be forced to acknowledge that this is a great and inestimable blessing with respect
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to the rearing this kind of stock. And we shall soon see that nature has not been less liberal in providing the means for improving the quality of the wool, *supposing it was not originally so fine as we wished it to be.* To understand this last particular fully, the following fact must be especially adverted to:

It is a fact well known, and confirmed by daily experience, that *every distinct breed of sheep, whatever qualities it may possess, continues to propagate its own kind without any PERMANENT variation as long as it is kept from intercopulating with other breeds of sheep: But if different breeds be suffered to intercopulate, a mongrel breed is produced, which participates of the nature of both the parents, without possessing in full perfection the qualities of either. This mongrel breed may be in like manner again farther altered, by being mixed with other breeds; and so on in infinitum.**

2dly. By attending to this fact we shall be able to perceive in what respect *human industry* requires to be exerted in improving the quality of the wool of any particular district, and be made sensible that if this be neglected, *whatever the nature of the climate may be,* it is scarcely possible but that the quality of the wool produced there, if it has been fine

* See this fact also proved, in opposition to the doctrine of M. Buffon on this subject. Observations on National Industry, Let. VII.

to an uncommon degree, must be in time considerably deteriorated.

The different breeds of sheep are diversified almost without end; and they are so much intermixed in every country in Europe, that if the best breeds are not carefully attended to by their owners, and kept in flocks of one common kind covering a large extent of country, they will be constantly intermixing with others, and thus be greatly debased. The influence of climate can extend no farther in correcting this disorder than has been already specified. In the same climate may be found two breeds of sheep, one of which carries wool like coarse hair, and the other fine wool, soft as silk. This last breed, if perfectly secluded from the other, may be preserved without degenerating for ages; but unless this seclusion, at the proper season, be perfect, it will be every year more and more debased. It is, however, a fact well known to every sheep-rearer, that sheep at the *rutting* season acquire a sort of *furor* of sex, if that expression will be admitted, which renders them at that time restless and active beyond measure, so that no fence, that can be made at a moderate expence for the purposes of husbandry, can then keep them confined: hence it becomes a matter of very great difficulty to preserve a distinct breed without adulteration,

tion, in any country where more than one individual breed is to be found; and it is next to impossible to preserve a *small number* of sheep of a particular breed uncontaminated, for any length of time, in a country where other sheep abound.* Indeed, the intermixture in this case is so unavoidable, and so frequent, that it seldom happens but the very appearance and distinguishing peculiarities of the new breed are, in a few generations, entirely lost among the superior prevalence of the greater number.† From this circumstance it must
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* The following fact relating to this subject shews not only the ardour, but the vigour of this little animal at the rutting season. A patriotic nobleman in Scotland had obtained a particular breed of sheep that he wished to preserve uncontaminated. With this view he put them at the rutting season into a deer park that was surrounded by a very high wall, which it was supposed no sheep could overleap; but in spite of this, and every other precaution that could be adopted, the careful shepherd discovered one morning a ram of the sort common in that neighbourhood, that had got among his fine ewes. This occasioned great uneasiness. The ram was immediately taken up, and though it was known that he could not have been longer than *one night* among the ewes, my informant assured me he had the best authority for saying, that at the yearning time it was discovered that no fewer than *eighty* ewes had been tupped by that ram; the lambs of that breed being distinguishable at the first glance from the others.

† It will be easily perceived, that from this event always taking place, mankind, who seldom are very accurate in their observations, may, in general, be readily disposed to look upon this very fact as a proof of the influence of climate in altering the wool. As the strange breed of sheep soon acquires, in this case, the same qualities with the original
 breed,

ever be an enterprize of very great difficulty for the inhabitants of most countries where sheep carrying wool of a coarse quality much abound, so to preserve a strange breed of fine-wooled sheep, as that their descendants shall continue to carry as fine wool as that of the parent stock; for as the finest breeds of sheep, wherever they are to be found in foreign countries, must be purchased at a considerable price, and transported at a great expence, the original stock of such fine breeds of sheep that can thus be obtained, will generally be very few in number, and, by consequence, they will be very quickly debased.

breed, the climate is, with some appearance of reason, thought to favour that breed more than the other, and thus to produce the change. They do not advert that this change is only observed to take place among the young which have been there produced, and that the original stock, as long as they continue in life, always retain their original peculiarities as distinct as at the beginning. This proves that it is from a mixture of blood, and not from the influence of climate, that the gradual assimilation is produced.

Those who have not much adverted to this subject will think they see a sort of contradiction between what I here say of the permanency of the breed, and what I said of the influence of the climate in altering the fineness of the filament of wool; but a little attention will remove this difficulty. The climate produces no *durable* change of the nature of the animal, but merely a *temporary* variation which immediately ceases when the cause that produced it is removed. The change by intermixture of blood is on the contrary a *permanent* change, that is equally observable in every variation of climate.

From these considerations we clearly perceive, that when France attempts to obtain a particular breed of sheep from Britain, or elsewhere, for the purpose of improving her wool, she has to struggle with obstructions that *nature* has thrown in her way, that are infinitely more difficult to be removed than the feeble bars that human laws have sometimes attempted to rear; bars which by an enterprising spirit might, in all cases, be easily surmounted. But to *Britain*, indulgent nature has been in this respect peculiarly kind, by having of herself, and without any effort on our part, effectually removed this otherwise unsurmountable difficulty, and thus has put it in our power to propagate any particular breed of quadrupeds we may incline, by enabling us to keep it, as long as we shall think necessary, perfectly isolated from every other breed, without subjecting us to the smallest expence to effectuate that seclusion.

The intelligent reader will readily perceive that I here allude to those numerous islands, islets, and holms, that are thick scattered along the western and northern coasts of this island. The climate of these small islands is temperate and equable beyond that of perhaps any other part of Europe; and the grass in many of them is peculiarly adapted to the rearing of sheep. There, the flocks would
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be in little danger of suffering for want of food in winter storms, as snow is rarely seen to lie there for two or three days together during the season. These islands are also of such various dimensions, that they may be found from less than one acre to more than a thousand, or even ten thousand acres in extent; and they are all so thoroughly fenced, that unless a sheep were to fly through the air, or swim over a large arm of the sea, any particular breed that may be placed there would not run the smallest risk of being contaminated.

These are advantages which France can never hope to possess, and they give to Britain a decided superiority above rival nations in this important branch of rural œconomics: for here, without trouble or expence, should we be able to obtain even no more than *one* male and *one* female of a particular breed, we can rear them with a *certainty* that the breed shall not be adulterated until it shall have increased so much as to admit of sending off colonies sufficiently numerous not to be easily debased. Here also the parent stock could be preserved for ages, and improved; from whence the colonies could be supplied with unadulterated rams, and fresh drafts of ewes, to keep up the breed, which without this precaution would, in more exposed situations, greatly degenerate. We have it thus in our power,

without trouble or expence, to make whatever experiments we may incline in improving the breeds of domestick animals, either upon a large or a small scale, as circumstances shall require. This peculiarity, duly attended to and properly improved, would, in a short time, give to Britain the full, and in a great measure the exclusive possession of wool, finer in quality than that not only of any other part of Europe, but even superior to any that can now be obtained in sufficient quantity for manufactures in any part of the globe. Thus would our woollen fabricks become superior in quality, and inferior in price, to those that could come into a competition with them in any part of the universe. Nor are these idle theoretical conjectures, but undeniable facts, founded on the sure basis of experience and sound reasoning. Let us not, therefore, longer neglect to avail ourselves of these singular advantages that heaven hath so bountifully conferred upon us! The means are easy, as the end is great.

To effectuate these desirable purposes, I beg leave to propose, that a society should be instituted under the name of *The Society for improving the quality of British Wool*. This society to be constituted on the same general plan with that of the Society of Arts in London; to consist of an indefinite number of members, each of whom should contribute *One Guinea*

Guinea a year, (this payment to be continued only during pleasure) the money, under the direction of a committee to be chosen annually by the members, to be applied—for promoting the improvement of British wool, by offering premiums, or by any other mode that shall be judged more adviseable for selecting the best and finest wooled sheep that could be found in this island;—for procuring the best breeds from foreign parts that could be discovered, and for rearing each of these distinct breeds apart, and increasing the number of each, till their respective qualities could be distinctly ascertained, and their value accurately appreciated. To give some idea of what might be done by this society, I shall beg leave to suggest a few more hints that have occurred to me in reflecting on this subject.

There exists in this island at present the remains of at least *three* distinct breeds of sheep, that are peculiarly valuable on account of the quality of the wool produced when uncontaminated by foreign mixtures, but which, in the present state of this country, run a great risk of being entirely lost in a few years, if no effectual method shall be now taken to recover and preserve them. The first care of such a society should naturally be directed towards the recovery and preservation of these valuable breeds of our native sheep.

The first of these kinds I shall mention, as being perhaps the most nearly lost, and as carrying the finest wool that has been known in this island, may be distinguished by the name of the *Highland* breed. This breed of sheep was formerly to be met with in the higher parts of Aberdeenshire, and in all the counties of Scotland to the northward of that; but now the breed is there so much adulterated by intermixture with other sorts, as to give no room to hope that any of the genuine breed could be found in those parts. In the Western islands, though for many years past little attention has been paid to sheep, the original breed has not been quite so much debased as on the main land; and some of them might there be picked up with care tolerably good. The same sort of sheep, I have also been told, are found in the Orkney islands; but it is believed the purest of this breed that at present exists is in the Zetland isles. This is a small, hardy, though delicate looking animal. Its wool is remarkably fine in staple; but its most distinguishing peculiarities are, a silky gloss to the eye, and a peculiar softness to the touch, that no other wool I ever saw possesses. It is not frizzled up like Spanish wool, but in its native state is gently waved, and is rather longer in the staple. When compared with the best Spanish wool that could be bought

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In the London market, it was found, upon a fair comparative trial, to be finer than the Spanish, in the proportion of nearly seven to four. Stockings have been made of it in Aberdeen that were sold for five and six guineas a pair; and at this present time many pair of stockings are made of it each year in Zetland, which, though not delicately manufactured nor properly dressed, but merely on account of the fineness and peculiar *softness* of the materials, sell in the shops at fifteen and sixteen shillings a pair. The sheep of this breed are for the most part entirely white, but some of the same sort are of a dun, or fawn colour, some black, but a greater proportion of a beautiful silver grey, with a fine glossy lustre. Many of them have been much debased by an intermixture with a very coarse wooled sort of sheep, which carries a great quantity of dry brittle hairs among the wool. This kind of hair, I am told, is in some places of England called *kemps*.

It will perhaps be a difficult matter to recover a pure unadulterated breed of this kind of sheep; yet I should not think it altogether impossible. In some of the small islands they may perhaps be found very pure; for in those parts the natives have so entirely neglected their sheep as not to have unintentionally debased their breed, under the idea of improving it. Perhaps the easiest way of recovering
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that breed of sheep would be to offer a set of premiums for the best ewes, and the best rams of this kind, to be distributed at a place that should be judged the most convenient in Zetland, at the most proper season of the year. These premiums might be, for the best ewe (or rather perhaps ewe lamb) carrying the closest and finest fleece, say five guineas: for the second-best, four guineas; for the third, fourth, and fifth, three, two, and one guinea respectively. In like manner, for the best ram, five guineas; and for the second, third, fourth, and fifth, four, three, two, and one guinea successively. It being a condition, that those for which the premiums are given shall remain the property of the society, if the owner does not rather incline to keep the sheep, and forego the premium. The price of sheep is so low in these countries, that this set of premiums would probably bring together a great concourse of the best of this breed, which are at present widely scattered through those lonely isles, and would afford an excellent opportunity of picking up a great number of them at a moderate price, besides those for which premiums were given.

It would be proper in this, and in all other cases of the same sort, for the judges to have along with them an expert woolstapler, for the purpose of enabling

enabling them to determine with facility and accuracy which was the finest wool.

Another set of premiums exactly similar to these might be offered in the Isle of Skye, which is the most central place for the Western islands. Whether it would be proper to have another set for the Orkneys I cannot tell, being as yet but imperfectly informed as to the nature of the breed of sheep in those parts.

The other two valuable breeds of sheep, natives of this island, are those that carry the long wool fit for combing, of the finest quality, and that kind which carries the best short clothing wool. Both these breeds are natives of England and Wales: but in what places the finest of either breed are to be found, and what would be the readiest way of obtaining the best of either sort, other gentlemen of the Society would be much better judges than I can pretend to be.

Spanish wool is now in such high estimation for manufactures, that it would doubtless be one of the first enterprizes of this Society to obtain a parcel of this breed of sheep: and though the penalty for transporting sheep out of Spain be nothing less than death by law, yet it will be no difficult matter

to get any number of sheep from thence that may be wanted, by a procedure it is not necessary for me here to explain. The only *real* difficulty will be to find a person who is capable of choosing the best sort, to pick them out there, who would not be liable to suspicion: but this difficulty may be overcome.

It would perhaps be adviseable to obtain from thence *at the first*, not less than fifty or sixty ewes, and ten or twelve rams. By obtaining such a number at once, the breed would not only be the more quickly increased in Britain, but a chance would also be given to correct any error that might be made in choosing them; as it is not probable, that among such a number there would not be some individuals of the finest sort, that might be separated from the rest to keep up the *purest* breed. The supernumerary rams too, might be put to the pick of our own ewes, to improve their wool by the cross breed. As the first cost of these sheep in Spain would not be great, and as the expence of transporting them hither would not be considerable, it would perhaps be right to obtain a still greater number, if the society's funds were adequate to it; as the nation would thus the sooner derive a benefit from this improvement,

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The Spanish sheep not only afford a fine wool, but, as they are a large, stately, full-bodied animal, they would, if well chosen, be valuable on account of their carcase as well as their fleece.

Another breed of stately, well-bodied sheep, that likewise carry fine wool, are to be met with in Barbary, and would, no doubt, claim the early notice of the society.

It is not to be expected that the *Tarentine* sheep will now, after so many ages of neglect, carry as fine wool as in the time of the ancient Romans, when it was so highly celebrated: but we are assured by modern travellers, that these sheep are still distinguished above all others in those regions for the fineness of their fleece. It would therefore be proper to try to obtain a few of the best of this breed: and though the wool that they produce in their native country should perhaps be found to be coarser than some of the finest of our own, this ought not to bar the trial, as there can be little room to doubt that it would be considerably improved by rearing these sheep in our colder climate. This observation will also apply to the sheep of Barbary, and all others that come from warmer regions than our own.

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The only other breed of European sheep I have heard of, that promises to answer our present purpose, is one that has been lately discovered in the Crimea, which carries a fleece of a grey colour, and very fine quality: but it is not yet enough known to enable us to speak of it with any degree of certainty. It is, however, well worth enquiring after, on account of the warmth of the climate, as it would probably be greatly ameliorated by being transported hither.

The finest wools, however, that are brought to European markets are the production of Asia. *Persia*, *Cashemire*, and *Thibet*, are the countries from whence they come; and it would be an object of great importance, and highly worthy of such a society, to obtain some of the best breed of the sheep of each of these countries. This must, indeed, be a work of time, and will be attended with difficulties and expence; but these difficulties are not of such a nature as to be unsurmountable. The sheep is an animal that, when young, can be easily tamed, and can become so entirely domesticated as to follow man like a dog, partake with him in any kind of vegetable food, and lie in his chamber. To sheep so trained, a journey either by land or by sea, is not a matter of great hardship; and in this way they may be brought hither. Some of the

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the Thibet sheep have already found their way into Bengal, where they never can be of any use; but none of them have yet been imported from thence into this country. Travellers mention an animal of that country of the goat kind, called *Touz*, which carries a fleece much finer than the wool of their sheep. Enquiries should be made if such an animal exists, and if it does, some of them, if possible, should be brought to this country; as there is little reason to doubt but they would here prosper abundantly.

The *Paco* and *Vicuna* of South-America, commonly called *Peruvian sheep*, though they be, strictly speaking, of the camel tribe; yet as they carry wool of the nature of that of sheep, only finer in quality, should also be attended to by the society. Could a few of these animals be obtained here, there is great reason to believe they would thrive very well in Britain, as they naturally delight to dwell only in the cold regions of the Andes, and have been found to do very well at Aranguez in Spain, where a few of them have been kept for several years past merely as a curiosity. Could we produce a sufficient quantity of this kind of wool, at a moderate price, it would give many of our *finest* manufactures a prodigious advantage over those of our rivals, as is sufficiently obvious.

The

The only other animal that occurs to me, as carrying a fleece useful in our manufacture, is the Angora goat.* This kind of goat has been reared in France and in Sweden; in both which places it thrives as well as in its native country, and carries the same kind of long silky fleece. There cannot therefore be a doubt but it would thrive here also: and it could be kept from intermixing with other breeds of goats in the same way as the sheep. It is probable the most rocky and inaccessible islands, if stocked with this class of animals, would return a much greater profit than they could be made to yield in any other way, were the fleece sold even at only half the price it now yields in Britain. This animal therefore seems to be highly deserving the attention of the society.

To be prepared for receiving and propagating these different breeds of animals when they can be obtained, it will be necessary for the society, immediately after its institution, to provide a proper theatre for these experiments. Many places might be pointed out as being well adapted for the pur-

* I hope no apology will be thought necessary for taking notice of these animals, which are not strictly of the sheep race. In a disquisition of this kind it is the nature of the material, not the class of animals which produces it, that ought to be chiefly adverted to. A these materials are sufficiently analogous to be, without impropriety, admitted in this essay.

pose here wanted ; but those which, upon the whole, appear to me the best, are the islands on the west coast of Mull, in Argyleshire. These islands are numerous, many of them small, and yield excellent pasture. On these the parent breeds might be placed, perfectly secure from all danger: and as other larger islands of various dimensions lie near them, the stock might easily be removed to these, when their increase was such as to require it, and would still continue to be under the eye of one superintendant. As most of these islands belong to the Duke of Argyle, who is at all times disposed to patronize and encourage every plan that promises to be beneficial to the country, there can be no doubt but he would be ready to grant to the society every accommodation that could be *reasonably* expected from him. And though the society would no doubt pay a rent for such land as they acquired, yet if that rent were not greater than what is usually paid for such land in that country, they would find no difficulty in getting such islands as they had not immediate occasion for, let, at the same rent from year to year, till they should find it necessary to occupy them themselves. As for those islands that were stocked by the new breeds of sheep, I do not suppose the loss by them, if any thing, could be great; for rents there are low, and the wool, it is

to be supposed, would sell at very high prices compared to what it brings there at present; so that if this department were managed with an ordinary degree of skill and honesty, the expence incurred there would probably be altogether, or very nearly, repaid by the produce of the flocks. Under the management of an individual, for his own account, the return would no doubt be much more; and, after the sheep were once obtained, the breeding of them might prove, to such individuals, a business highly lucrative; but under the direction of a publick society, this ought not to be looked for. Individuals, however, who possess the islands scattered around these, would have an early opportunity of procuring the best breeds, and would no doubt quickly avail themselves of the benefits that might be derived from that source. It would be no small advantage to them to be able to send their wool to market along with that belonging to the society.

If ever this society should be instituted, it would seem, for many very obvious reasons, that *London* ought to be the place where it should be constituted, and where a secretary ought perpetually to reside, who, under the direction of the committee, should transact the business of the society; send the necessary commissions to foreign parts, and issue orders to the domestick overseer for regulating his conduct.

It

It will be unnecessary to dwell upon the benefits that would be derived to this country from an institution of the nature here proposed, these being abundantly obvious. It seems indeed to be not a little surprising that a thing of this kind should not have been thought of long ago. This can only have been occasioned by the fatal prevalence of those false notions, that have been so long industriously propagated, concerning the superiority of British wool above all others;—an absurd notion that has been long eagerly cherished, though it is directly contradicted by our daily experience.* It is owing to this cause alone, I apprehend, that the subject has never hitherto properly attracted the publick attention. It is to be hoped, that when it does

* That Spanish wool has been long an article of import into this country every person knows, but few know exactly the amount of that trade, or the sums of money that are annually sent out of this kingdom for that article, most of which is consumed in clothing ourselves. By an account that was laid before Parliament last year it appears that, on an average of several years past, about three millions of pounds of Spanish wool have been imported by us; but that the amount of this importation is augmenting from year to year, and that in particular, in the year 1787, no less than four millions one hundred and eighty-eight thousand two hundred and eighty pounds of Spanish wool were imported into Britain; the value of which was upwards of *six hundred thousand pounds*. An immense sum, to be *needlessly* given by us for the purpose of encouraging the agriculture of Spain, that might be infinitely more beneficially employed in augmenting the products of our own fields, and promoting, by the cheapness of the raw materials, the manufactures and the commerce of this country!

come to be properly adverted to, men of liberal minds in every rank of life, perceiving its great importance, and observing at the same time the trifling effort that is required to confer the most solid advantages on their country, will emulously press forward to obtain an honourable place among that list of patriots, whose names will doubtless be preserved to future ages by a grateful people, who, while they enjoy the benefits this association has conferred upon them, will with social joy celebrate their praises. And though there can be no doubt but the efforts of individuals would be altogether sufficient easily to effect these salutary purposes, without any public aid, or royal assistance; yet it would be highly unbecoming of those who should plan such a laudable institution not to solicit the royal patronage, and to put it in the power of the King, or the Prince of Wales, to have the honour of being the patron of an undertaking so suitable to the dispositions of those who glory in the titles of the father and the friend of their people.

The effects of the *royal bounty*, in improving the breed of another valuable class of animals, *the horse*, are well known. By a similar bounty in the present case, though much more limited in extent, effects similar in kind, but of infinitely greater national importance, might be expected to be produced.

May

May the happy time soon arrive, when the *sheep* of Great-Britain shall as much excel the sheep of all other nations, in respect to the fineness of their wool, and other valuable qualities, as the *horses* of this island now confessedly exceed all others in swiftness and in bodily strength! Nor have we room to doubt, that with an equal degree of attention and care, the former event could be much sooner effected than the latter has been compleated, since it has been clearly demonstrated, that our climate is naturally suited beyond most others for the production of *fine wool*; and our circumstances in other respects uncommonly favourable for its improvement. Though, with regard to horses, this island being able to boast of no peculiar natural advantages, the pre-eminence she holds in this respect must be confessedly the result of continued care, and unceasing attention alone.

ARTICLE XII.

The two following papers, furnished by a gentleman well known and respected for his abilities in the improvement of Grass Lands in the county of Somerset, we give in his own style and manner. The first of the two, if examined with the strictness of agricultural criticism, may be liable to some animadversion, on account of the extraneous matter with which it

is accompanied in the notes; but as they take up but little room, and may serve to illustrate the rustick character of a considerable part of the subordinate classes employed in the husbandry of the county, they are admitted. The information, indeed, is not to be considered as of any great consequence to the practical farmer; but as in conversation, so in reading, those anecdotes of pleasantry which happen to be excited by local subjects, are not without their use in relieving the mind from the uniformity of severer studies. Some of our readers will smile, not disagreeably to themselves; and we trust no one will be offended at the peculiarity of a writer with whom many may hope to be better acquainted. The communications of Mr. Locke, so far as they respect improvements, we are informed, are the result of practice founded on his own reflections, unaided by the perusal of agricultural authors; and therefore they have the recommendation of the greater originality.—We shall be glad of his further correspondence, more especially if his professional line should furnish him with useful observations on the diseases and management of cattle in low marshy countries, as well as the lands on which they feed.

*On the Improvement of Meadow Land;—with a
short History of a part of Somersetshire.*

[By Mr. LOCKE, in a Letter to the Secretary.]

SIR,

Burnham, Feb. 2, 1789.

I Promised in my last letter to give you some account of the methods I have made use of for these forty years past towards the improvement of Meadow Land; previous to which I think it necessary

sary

fary to present you with a short history of the flat part of Somersfethire, wherein I was born and have always lived. *Brent* and *Banwell's Marsh*, as it is called upon the old maps and records, but at present better known by the names of the *North* and *South Marsh*, with some few parishes adjoining, comprehend all the lands situate between the Mendip and Poledown hills, quite home to the Bristol Channel; containing together 42 parishes, composed of the hundreds of *Bempstone*, *Brent cum Wrington*, *Winter-stoke*, *Huntspill cum Puriton*, and part of *Whitley* and *Glaston Twelve Hides*.

I have taken an actual survey by admeasurement of a great part of these lands; and, estimating the parishes I have not surveyed in their due proportion, I find the whole together will amount to about 3000 houses, 20,000 inhabitants,* and 128,000

* I have counted the inhabitants of about twenty parishes, and estimating the others after that rate, they may be divided as follows:

Husbands	—	2,500	Wives	—	2,525
Widowers	—	600	Widows	—	1,000
Batchelors	—	700	Spinsters	—	300
Sons	—	4,500	Daughters	—	3,500
Male-servants	-	950	Female servants	-	1,025
Male apprentices	-	400	Female apprentices	-	400
Male lodgers	—	850	Female lodgers	--	800
		<hr/>			<hr/>
Total males		10,500	Total females		9,500

N 3

acres,

acres, the waste land included. To the above add the low lands watered by the Tone, Parret, Ivel, Bru, Brent, Ax, and the Congre, all which rivers discharge themselves into the Bristol Channel, and we shall have 128,000 acres more at the least. A considerable part of these lands are included in King *Arthur's** grant to the abbey at Glastonbury, dated 21 May, 542, in addition to that which King *Arviragus* had given it before. *Ina*, eleventh king of the West Saxons, anno 704, built the first church at Wells, where the cathedral now stands, and from his grant in *Dugdale's Monasticon*, dated 725, it appears that he gave great possessions to the church of Glaston; and *Kenulphus* the fourth king after him granted, anno 766, a tract of land containing

* King Arthur, son of Uter Pendragon, who was the brother of Aurelius Ambrosius, having fought a great number of battles, and performed a variety of noble acts, was himself slain at Camelford, in Cornwall, by Mordred, son of Gouran, King of the Scots, whom he had by Anna, one of the aunts of Arthur. [See *Ninius* and *Marianus Scotus*.] His body, in the 36th of Henry II, anno 1189, was found buried at Glastonbury, with *Gunever* his queen. *Giraldus Cambrensis*, the historian, was an eye-witness to the finding these remains. The lead cover was preserved in the treasury of Glastonbury till the suppression of its abbey by Henry VIII. on which was a Latin inscription in rude letters, thus englished, "Here lieth King Arthur, buried in the isle of Avalonia." See *Stow's Annals*.

I do not recollect whether the term Brent be in King Arthur's grant; but if so, it contradicts the received opinion that Brent marsh took its name from *Le Sire de Breant*, a famous Knight Archer, who came into England at the Conquest. See *Hollingshed*.

two large manors for the support of *Ina's* church at Wells. The old charter of endowment may be seen in *Godwin's Bishops*.

The earldoms or counties of England must have been subdivided before *Honorius*, the fifth archbishop of Canterbury, divided his see into parishes, anno 636; and it is a doubt with me whether King *Alfred*, who died in 901, did not improve, or rather complete, the plan of some of his predecessors in dividing the kingdom of England into hundreds and tithings; for I cannot conceive that the hundred of *Williton Free-Manors*, which contain 31 parishes, and the hundred of *Taunton-Dean*, which consists of 30 parishes, (and which was the residence of King *Ina* near a century and a half before *Alfred's* time) had each so few as one hundred houses in it when this subdivision took place. However this be, we can, with the assistance of *Domesday-book*, old *Peerages*, *Dugdale*, *Tanner*, *Camden*, *Speed*, and some other itineraries, trace most of those manors and parishes that compose these marshy lands to, and some beyond, the Conquest. Amongst these are, *Wedmore*, where *Alfred* sometime resided; *Auler*, where the Danish King *Gothrum* met *Alfred* to be baptized; *Banwell* and *Congresbury*, which King *Edward the Confessor* gave to *Dudoco*, the fourteenth bishop of Wells, as an addition to his
see.

fee. *Tatton* and *Winscombe* were added at the Conquest to please Bishop Giso, from whom King Harold had taken part of his lands, and gave them to the monastery of Gloucester. Bishop Joceline,* who founded the Prebends and Chapter of Wells, added to his fee the parishes of *Chedder* and *Axbridge*; the last gives name to the deanery, in which the chief part of these marsh lands are situated.

Amongst other parishes of great antiquity is one called *Bleadon*, a corruption of *Bloody-Down*, so called from the great slaughter of the Danes by Ernulph, the supposed son of Hun second earl of Somerset, anno 845. Indeed, if we examine antiquity, we shall find that in the names of all places so ending, *-don* is only a corruption of the word *down*, just the same as *ton*, at the end of other places, is a corruption of the word *town*; from whence we may conclude, that the parish of *Lockston* was originally the dwelling or town of *Locke* perhaps long before the Conquest. *Locksend* (now corrupted to

* This Bishop is said to have given an estate in Bath, called *Saint John's Farm*, valued at 60l. per annum, for the support of six widower men, six widow women, and a purveyor; which farm I was employed to survey in the year 1774, and it was then so much improved by buildings as to be worth little less than 10,000l. per annum. It is at present called the *Blue Alms Charity*; and notwithstanding the marvellous increase of rents, it is still appropriated to the maintenance of thirteen people only.

Locking, as if a participle) was one end of the possessions of *Locke*, as also *Locksend-Head*, *Lock's West-Town*, now called *Weston above the sea*, and many others of like import. Adjoining *Lock's-Town* on the East is a parish lying between two hills called *Comb-Town*, which in all probability the proprietor of *Lock's-Town* bestowed as a gift upon one of our ancient Bishops, being at present called *Compton-Bishop*, and dignified with having a prebend's stall in the cathedral church of Wells. The same observations may be made on the land adjoining called *Winterton*, *Winterscombe*, *Winterhead*, *Winterbill*, &c. all which names seem to signify to us that the villages thus called were one time or other the property of one *Winter*, unless we can suppose them to have been called thus from the season of the year.

It may be observed, that most of these parishes, which have the appearance of antiquity, have a small portion of land higher than the marshy parts, and the churches are built upon such places as were not likely to be overflown by the sea. Indeed the whole of these marsh lands, which comprehend the quantity of acres contained in twenty miles square, were one part constantly, and the other frequently, overflown either by the sea or land floods, until the reign of Henry II. when banks were made

to

to keep back the tide; but it was not till the reign of Queen Elizabeth, that the no less famous than useful dam called *Highbridge* was built, having three large arches sufficient to drain the country, with flood-gates of such strength as to keep back the tide; so that we frequently see the water on the West side of the bridge lying against the sea from twenty to thirty feet higher than it is on the East or land side.

Perhaps this draining the land gave rise to some new parishes; their very names seem to indicate as much, viz. *Chad Sea*, i. e. the land late a sea, dedicated to *St. Chad*; *Middle Sea*, lying between the parish of *All Dry*, (now *Audry* or *Othery*) and *West-town Sea and Land*, (now *Westonzoyland*) *Badgewarth*, that is, the *warth* (or *warf* as anciently spelt) of *Badge*; *Hunt's Pill*, that is, the *Pill* of *Hunt*, and so of others. It seems as though *Lympsbam*, together with *Burnbam*, *Berrow*, and *Brean*, whose churches stand within a few yards of high watermark, are still more new; nay, the two parishes of *Biddes-bam* and *Aller-town* were, long since the Revolution, actually chapels of ease to *Wedmore*; and the flourishing parish whose church is dedicated to *Saint Mark*, is a spurious issue of that ancient place; for although it has 800 souls in it at this time, the publick knows it by the name of *Mark*
only

only, without any surname; and it is left totally unnoticed as a parish in Bacon's new as well as every other edition of *Eton's Thesaurus*.

I am the more convinced the flat country I am describing was once overflowed by the sea, from the names given to certain places in it. Joseph of Arimathea and his followers, according to *Treculas*, lib. ii. cap. 4, had as much land given him as could be surrounded by twelve ox-hides cut into small thongs, which he at first called *Ynifytrin*, but afterwards the Island of *Avalon*; at present it is called *Glaston Twelve Hides*. The high hill called *Brentknoll* (on the top of which was a Roman garrison*) was stiled by the monks of Glastonbury, in an ancient grant of theirs, the *Little Island of Frogs*,† and became famous for giving birth to the noted *Adam de Marisco*, i. e. *Adam of the Marsh*, an author of great piety and learning, who flourished in 1257. Besides the above islands, there are a great number of villages, farms, and places, called *Islands*, *Isle-ports*, *Hills*, *Mounts*, *Batches*, *Warfs*, *Warths*, and *Waths*, with the epithets *great*, *little*, *long*, *short*, *high*, *low*,

* The top of this hill contains about ten acres, having been surrounded by a thick wall, the traces of which are now visible; and within my own remembrance there was a large quantity of Roman coins found upon it, so that I cannot doubt of its having been a Roman station.

† See John Rouse.

higher, yonder, over, under, supra, subter, nether, east, west, north, south, white, black, yellow, green, &c. all of which contribute to prove this flat country to have been once a sea. But if we may in this case rely upon tradition, for the digging up of ship's anchors many feet under ground in the marshy places, there cannot remain any possibility of doubt.

I have seen some grants of William I. and grants of manors soon after the Conquest, which I could both read and understand. They were not much unlike the long narrow chyrographs of fines wrote in Law-Latin Court-hand;* but I do not recollect to have seen in the leases of tenements for lives under these grants, any particular boundaries set forth, till since the dissolution of monasteries at the Reformation; and from hence I conclude that this flat country was no otherwise bounded than by ancient grants of manors, each of which was gelt at a certain number of hides,† and was under the feudal
tenure

* I have now in my possession one of these Law-Latin Court-hand chyrographs, acknowledged in Hil. term, 4th William III. between Francis Carlswett, Doctor in Divinity, and vicar of Bray in Berkshire, (the turn-coat vicar of Bray) plaintiff, and John Friend, of Taunton Saint Mary Magdalen, defendant.

† How shall we reconcile the very great difference at present subsisting between those authors who have laboured to ascertain the quantum contained in a hide of land? some having fixed it to be fifty acres,
whilst

tenure held in villenage* by the vassals of the great Lord, who for the most part held under the Crown by knight's fees and war services.

To

whilst others have as confidently called it a hundred. Perhaps both of these are right; for if we look into *Domesday-book*, we shall find one gentleman's manor gelt for twenty hides, which at present contains twenty hundred acres; and another gentleman's manor gelt at twenty hides, that contains only ten hundred acres. The fact is, a hide of land was just so much as could be tilled with one team, and so was more or less according to the industry of the proprietor or proprietors; for sometimes there were as many as six vassals to one hide, each of whom contributed his single ox, from whence the term *ox-gang*, or *ox-shut*, in certain inclosed pastures; and hence it is too that we find such a number of ancient tenements from ten to twenty acres each, which was exact one-sixth part of a hide of land. Great allowance must also be made in regard to the quantum contained in a hide, for the lands which lay uncultivated at the Conquest may at present be in a high degree of culture; no wonder therefore that in this flat country (a great part of which hath been new made since the Conquest) we sometimes find the average hide of a manor to contain several hundred acres. The price of a hide of land a little before the Conquest was fifty shillings.

* One branch of this service, as it was introduced before and at the Conquest, in a few particular places in England, gave the Lord a privilege of sleeping with his tenant's daughter the first night after marriage; but the good Queen Margaret, granddaughter of Edmund Ironside, and mother-in-law to our Henry I. in consequence of her marriage with Malcolm king of Scotland, did, for a round sum of money, compound with the great Lords of that kingdom to abolish a preposterous custom big with evil against nature and civil liberty; and King Henry so far followed his mother-in-law's example, as to discountenance it in England, by wholly freeing such of his subjects who laboured under this heavy yoke, upon their paying 6s. 8d. which was indeed such a pitiful price for a woman's virginity, that the custom

very

To every manor belonged a mansion with more or less land in demesne inclosed near it, always sufficient for the maintenance of the family, without the lord's being under the necessity of intercommoning with his tenants; and this is the only reason that can be adduced why the manor-houses are at this day precluded all interest and advantage arising from the multiplicity of new inclosures under different acts of parliament for that purpose. The demesne seems to have been the only land identified, except the old *auster** tenements and their

very soon became universally abolished. But this libidinous privilege of the lords of some manors had taken such deep root in the minds of some of their vassals, that they had their younger sons preferred before the elder,—a borough English practice that is still kept up in many parts of England, particularly about thirty parishes in Somersetshire, lying in the hundred of Taunton-Dean, the customs of which I sometime since published, price 2s.

* *Auster* being a provincial term, not intelligible by gentlemen at a distance, it may not be amiss to acquaint them that it is peculiarly applied to some parts of this flat country. The term itself is differently spelt in different grants; whence the learned have given us many different conjectures of its derivation, most of whom believe it purely Saxon; but whether so or not, its true original import signified an oven, for want of which a hearth or fire-place, but of such a construction that it must be capable of baking bread. All such villanes who in early times would venture to live on those marshy lands, and erected a cot of such consequence as to have a hearth or oven that would bake their own bread, had a privilege of unlimited intercommoning, provided they possessed themselves of one ox, and cultivated a sufficient quantity of ground to find themselves and families in corn.

homesteads,

homesteads, for the manor was generally divided into three large inclosures, called a *ham*, a *meadow*, and a *field*. In the ham all the tenants fed their cattle in common during the summer season, after the same manner as commons in grass are fed at present. For winter fodder, all the tenants, the first day after the Nativity of St. John the Baptist, mowed promiscuously in the meadow land, commonly beginning at twelve o'clock at night, and continued mowing where they pleased according as their judgment pointed them to the best grass; but if a tenant surrounded more land than his strength enabled him to mow in twenty-four hours, any neighbouring tenant who had finished mowing the piece he had marked out in the morning, had a prescriptive right to break in upon such surrounded land for the last hour or two, more or less, and continue mowing till the twenty-four hours were fully expired. The more wet or poor parts of the same mead might be mowed at any time, and by any tenant who supposed his single day's mowing insufficient to support his cattle in the winter.

A full day's mowing was emphatically called a Mead, and when the tenements came to be identified and bound-stones set up, they were always estimated at five acres each. I have surveyed some hundreds, perhaps thousands of those meads, and
find

find them to contain from three to three acres and a half each, statute measure.

In somewhat after the same manner the farmer tilled his arable land; for the chief villager, or earliest riser, began to plow in the common field where he pleased, drove on till his cattle wanted breath, and then turned about; which commonly happened at the length of one-eighth part of a mile, from hence called a furlong, so the full day's work of the team was at the close of the evening called an acre.* Sometimes the plowman No. 1, owner of one ox, happened to be beat off by the rain at the end of half a day, in which case the plowman No. 2, who also owned another ox, began plowing at the same place, and so reduced the bit of land No. 1 to half an acre, nay sometimes to a single ridge or dole, commonly called a yard or plot, it being an indefinite term signifying one quarter of an acre, more or less. But the catching after land thus, as school-boys do for nuts, was, soon after the dissolution of monasteries, found inconvenient, which

* If the curious agriculturist will be pleased to attend to this circumstance, and recollect that we had no statute measure except the yard, whose length was determined by the length of the arm, he will readily be able to account not only for the difference in size of the acres in almost every country, but also for the ridiculous irregularity of fences and intermixture of property, to the very great injury of the different proprietors, and emolument of none but gentlemen of the long robe.

caused

caused the great lords to abolish, in a great measure, their old feudal tenures; and instead of so zealously distinguishing themselves by red and white roses, proceeded to inclose and identify their lands, on which they granted leases by the particular description of all those several pieces and parcels of arable and meadow, which were at the time of granting those leases actually in the occupation of the lessees, which lessees were not thereafter to be molested by any person whatever, together with an unlimited common of pasture in the ham or moor for the summer feeding of cattle. These old auster tenements were generally held for 99 years, determinable on the death of three lives; and at first under the easy annual rent of wheat, barley, oats, hay, cattle, geese, ducks, capons, wild fowl, cummin seed, &c. and on the death of the oldest life the best beast was generally advanced by way of fine *for a life*, and from thence called *farlief*, but long since compounded for money, and at present called a *beriot*.

The great Lords thus inclosing and identifying their tenements, this flat country gave great offence to the tenants, whose privilege of picking and chusing the best land was now at an end; they therefore sent a petition to Edward Seymour, the great Duke of Somerset and Protector of England, complaining of the Lords' incroachment upon their

privileges. The Duke issued out a proclamation for the levelling these inclosures, by a day therein-named; which not being complied with by the Lords, the tenants took the liberty of doing it themselves; and this brought on an insurrection in Somersetshire in the second year of the reign of Edward VI. The mob behaved very much after the same manner as the Irish white-boys did a few years since, from the same motive; but some of them having received exemplary punishment, the rest were pardoned, and returned to their allegiance. I never saw a feoffment or a grant in fee of small tenements, or portions of land, identified and bounded, prior to this æra; but in the succeeding reign we have them in great abundance, from which, with the assistance of the publick surveys, we may in a great measure discover the value of money between that period and the present time. If we examine the King's *liber valorum*, as taken for Somersetshire by Dr. John Clark bishop of Bath and Wells, Sir William Stourton, knight, Hugh Powlett, William Portman, and Roger Kynsey, esquires, in the thirty-fifth year of Henry VIII. we shall find this flat part of Somersetshire (herein before estimated at 256,000 acres) to be valued at about thirty thousand pounds per annum, which is almost half-a-crown an acre upon an average. At
the

the Revolution we find the value of these same lands increased to about seventy-six thousand eight hundred pounds, which is six shillings per acre upon an average: at present I value this tract of country at thirty shillings an acre, one with another; and from the minutest and best calculations I have been enabled to make in the course of forty years experience upon the spot, acting in the three-fold capacity of a considerable farmer, a practical agriculturist, and a land-surveyor, I adduce one general estimate, which may be arranged as follows:

Acres	Pounds per annum.
20,000 acres of rich pasture land in a high degree of culture, statute measure, exclusive of fences worth 2l. 10s. per acre per annum	50,000
30,000 acres of uneven pasture land in large closes, formerly arable, laid out to grafs in ridges 20 feet wide, in other respects as rich as the former, worth 2l. per acre - - -	60,000
60,000 acres of pasture land, which ought to be made into closes from 10 to 30 acres each, and so exchanged as to make farms within ring fences, in which case, it might, by good management, be made worth 2l. per acre in two years, worth at present 1l. 10s. per acre - - - - -	90,000

Acres.	Pounds per annum.
76,000 acres of meadow land constantly mowed, either under jointure, mortgage, uses, or remainders over unbarred, or belonging to lessees for lives, tenants for life by curtesy, joint common, or in tail, or some other impediment, which will effectually prevent the farms from being brought by exchanges within ring fences, and be thereby improved, worth 1l. 10s. per acre - -	114,000
70,000 acres of neglected land belonging to some charity, church, college, or dignitary, lying in small irregular pieces, being either coarse, wet, intermixed, undivided, ill-shaped, uneven, at a distance from houses, with bad roads, moors, uninclosed, and other uncultivated property, worth only 1l. per acre - - - - -	70,000
256,000 acres.	Total annual value £.384,000

I would not be understood to include in this calculation any ancient common field lands now in tillage, or lands that lie above spirit level higher than high-water mark. The calculation is made from neat statute acres, exclusive of fences and uncultivated corners; and the land-owner is to allow out of this estimate every kind of agricultural repair, and incumbrances of all sorts, with which

which the land, or occupier thereof, stands charged according to the custom of the country, so that the tenant has no payment whatever to make but rent only.

If the above calculation be admitted as founded on fact, the proportion of money will be as one to twelve from the Restoration to the present time. I know the clergy in their comments upon the valuation of the King's *liber valorum* add a cypher upon the right hand, which only makes the proportion to be as one to ten; but this is merely arbitrary, without calculation. In answer to which I do not recollect to have seen any grant whatever in Queen Elizabeth's reign, where the premises conveyed are not worth at present as many thousands as the consideration money was hundreds. Indeed *Pill's-Mouth Farm*, where I drew my first breath, worth at present 100l. per annum, cost my grandfather's father in the reign of Charles II. only 200l. in fee; which farm was purchased of the lord of the manor* in the reign of Queen Elizabeth

* The Popham family were lords of Burnham in the last century, and we have a tradition amongst us, that an ancestor of this family, when a young university blood, in company with two jovial companions, made too free with a gentleman's purse upon the road. Soon after Popham repented, and his companions thought nothing less than a discovery would follow, which in order to prevent they led him into a wood,

for the sum of 25l. only. It is true it lies against the sea, and has been occasionally subject to inundations by the overflowing of the tide, the last of which was anno 1737, and the next before that anno 1703.*

Having

a wood, fastened his hands behind him, fixed one end of a halter round his neck, the other end to a limb of a tree, and in this situation left him seated upon his horse. Popham was under dreadful apprehensions of his approaching fate, and so much the more as the grass grew short on which the horse had for a time very quietly fed; but he now began to stretch the rope by extending his circuit, and Popham, who had been humouring him with a jockey-whistle, began to cry out in great agony of soul, *Ho! Ball! ho! Ball!* but at the very instant he was about to swing off, he was relieved by one of his companions, who had divided from the other, and was returned back for that purpose. It happened that in a series of years Popham became a Judge, before whom his companion who had saved his life was convicted for a capital offence, and being asked why judgment of death should not pass, he mimicked the Judge's former tone of voice, and cried out *Ho! Ball! ho! Ball!* The Judge, who now recollected his face, told the Court that the prisoner appeared to be insane, and that he would respite sentence till next assizes, before which he found means to get the culprit pardoned and provided for.

* The manners of the inhabitants of this flat country cannot so well be judged of by a stranger as a native; they are civil or rough as the traveller pleases. Take an example founded on fact:—

“ Q. Hark you, fellow, which is my road to Frog-hole? A. What's call I fellow for? I, I, I, zed nothing to thee. Q. Well, my good man, I would not have you be offended, for I did not mean to affront you, but pray do tell me the road. A. Whare didst thou come from than? Q. Why, my honest friend, can it make any difference to you from whence I came? A. No shour and shour, but then it can be no odds

Having run into length, I shall only add at present, that I know several hundred acres which I remember to have been rented at 1s. per acre per annum;

odds to I where thou'st go." And so left the gentleman without telling him the road to Frog-hole, making a merit of his forbearance in not stoning him for a bailiff, an exciseman, or a spy; whereas, if the stranger had satisfied the impertinent curiosity of Hodge with rustick good-humour, he would have carried him through the waters on his back, if it had been a mile, for six-pence.

The labouring people amongst us are exceedingly ignorant; as a proof, the minister of Pawlet, at the time of the American war, chose for his text these words: "Who will go up with me to Ramoath-Gilead to battle?" After a short pause, and no person answering, one of our fishermen who had been a sailor stood forward, and told the clergyman though none of the rest would go with him, yet he would go.

A popular character may (if proof against the ague) live very comfortably and safe from free-booters in this country. The necessary qualifications are, riches, ignorance, and good-humour: one of this stamp, lately deceased, was more popular than any other, owing chiefly to a very trifling incident. The clergyman and he having drunk freely one summer evening at the publick-house, were returning home about twelve o'clock at night, when the parson had the misfortune to be set fast in a bog; and as men drowning will catch at a reed, so he petitioned his companion, very pathetically, for assistance. Our hero knew he was unable to afford his distressed friend any kind of relief, and told him so; but being overcome with his rhetorick, told him that it should never be said he had deserted him, and so coolly walked into the bog, and sat down by his side till morning, when they were both found and relieved. This gentleman's poultry were safe ever after, and what is more remarkable, his hedges escaped unmolested on the fifth of November.

The method of feeling a new parson, as usually phrased, is to call him up at twelve o'clock at night to baptize a child; if he goes voluntarily

annum; I remember the same lands sold in fee at 20s. per acre; and I know them at present to be worth 40s. per acre per annum. I know thousands of acres improved to double and treble their value, and the inhabitants of Burnham alone are forty

voluntarily and with much seeming good-humour, his character is established, and he is never more disturbed: but if he should happen to grumble, he is plagued into a compliance. However, the Rev. Mr. Diaper, of East-Brent, actually refused—the child died, not without suspicion of foul play—law ensued, and the parson wrote a very severe and violent satire, on Brent, printed, if I remember right, in the London Magazine, about the year 1738; I believe it may be read, with some alterations, in Dr. Bowden's Poems. I could repeat the verses when a boy, and recollect one at present:

“ The bleak knoll, and all the marshes round,
 “ A fort of chaos and unfashion'd ground;
 “ 'Twere made in winter we may safely swear,
 “ For winter is the only season here.”

Mr. Diaper barely escaped with the skin of his teeth, but his Poem tended greatly to enrich the inhabitants of this country, by keeping out all strangers, and keeping the price of land low. The judicious have allowed this poem to be a persuasive to the lords for dismembering their manors;—a lucky circumstance for the lessees, who became the chief purchasers, and whose descendants now live comfortably upon their own freeholds.

I could say much about wrecks. The last we had was on a Sunday, in time of Divine service, when every living soul deserted the parson, except myself and the clerk who had but one leg. However, if I were to write the history of this, or any other wreck, I might stand a good chance “ *to go to a wreck* ” myself. It will therefore be most advisable to be silent on a subject that, if divulged, would give offence to our neighbours.

thousand

thousand pounds richer than they were forty years since, which I attribute chiefly to the improvements made on their lands. The practical method of these improvements shall be the subject of another letter. At present I have only to add, that I am with much respect,

Your obliged and cordial friend,

R. LOCKE.

ARTICLE XIII.

On the Improvement of Meadow Land.

[By the Same.]

Burnham, 16th Feb. 1789.

DEAR SIR,

THE necessity of keeping meadow in a good degree of culture must appear exceedingly obvious to farmers of every description, but more particularly so to all owners and occupiers of *Dairy farms*, with which the flat part of Somersset I have been treating of more especially abounds. One-third part of these farms must be mowed every year, in order to supply the cows with winter fodder; this constant mowing cannot but have a tendency
to

to impoverish such lands, unless some proper methods are made use of to recruit its strength, and constantly keep it in such a due and regular state as to make the meadows produce the greatest quantity of grass they are capable of. Having studied this subject for these forty years past, I shall confine myself within my own practice, without paying attention to others; but herein I find great difficulty, being unavoidably obliged to speak in the first person, a task very disagreeable to farmers of a contracted education.

My grandfather died in 1748, when my father entered upon a dairy farm of about 200l. per annum. Part of this farm was seven acres and a half of meadow, then valued at 5l. per annum, having round its borders very high banks,* which had never been taken away from the time of its first being inclosed, and the middle of the field lay very low and wet. I advised the banks should be removed to the depth of six inches below the surface, sloping towards the ditches, and carried over the land, so as to make it entirely level, or, if any difference, highest in the middle of the field, which buried it in some parts to the depth of eighteen

* Banks here, and in all other places of this letter, mean nuisances, as being composed of the earth and clay thrown up out of the rhines and ditches which embound the fields and inclosures of this flat country.

inches.

inches. It bore a good crop of horse-beans where covered deep, and on the borders and such parts as had very little earth thrown over it, blue marrow peas were planted with good success, and plenty of white clover seed sown all over the field. This finished the business at the expence of twenty pounds, exclusive of the surplus value of the corn exceeding the 5*l.* for rent. The second year it bore a bad crop of grass, which was, however, worth more than 5*l.* the old rent. The third year it was something better; and by the fourth year it had a good found turf, so that the fifth year it was compleatly guttered; and by summer-feeding, in a few years, it became rich pasture land, without the assistance of a single load of dung or compost of any kind. It gradually increased in value till lett to a tenant for 15*l.* per annum, and has continued at that rent to the present time.

One close of eight acres belonging to this farm had been dug over in pits and pools, to repair the sea-wall, and so exceedingly bad and irregular that it was thought incapable of improvement. It was therefore let to a tenant for five years, at 4*l.* per annum. At the end of this term, during which 20*l.* being expended with success about the former close, operated as a powerful motive to attempt doing something to these eight acres: forty pounds
 were

were accordingly laid out in draining and levelling, by which simple method of improvement it soon became worth 15l. per annum, and was last year sold cheap by my sister's husband for 360l.

Four acres of this land were let at 40s. per ann. but being so exceedingly poor the tenant refused to continue the possession, unless the rent was abated to 11. per annum. This was insufficient to keep fences and pay taxes, which amounted to more than 20s. a year upon an average for forty years together. Here, then, was a close worth nothing, nay worse than nothing, for when it was left open to the common it had still taxes to pay. I had in early life travelled through Cornwall, and somewhere upon the southern coast in my road to Penzance observed the people busily employed in cultivating the land with sea sand.* This I recollected, and as the close lay within half a mile of the seashore, an experiment was tried sufficient to prove that perseverance would have been attended with amazing success; but having such mountains of dry sand upon the coast to pass over before we can

* Since I wrote the above I am informed by a gentleman from Cornwall, that the farmers of that county are so well acquainted with the good effects of sea sand as a rich manure, that it is taken in barges up the rivers as far as they are navigable, and afterwards carried on horseback ten or more miles before it is thrown over the land.

get upon the beach, it is morally impossible, in its present state, to haul it up. However, I am so fully convinced of the excellency of sea sand as a manure for clay lands, that had I but one acre adjoining the sea, I would make a road through it, though it should cost me one hundred pounds. By sea sand, you will observe I mean the sand upon our extensive shore* which is daily overflowed by the tide, by

* The mouth of the river Parret is near a mile over, in which was an island of about eighty acres, called in the old maps Dunbal Island, having a large river on the west, and a small river on the east, in each of which the vessels passed and repassed. It happened in the hard frost anno 1739, that the small river was filled with such vast quantities of ice that it turned the current into the large river; and before the ice melted it was so much covered with slub and slime as to prevent the low water from passing, and is at this time nearly level with the land, insomuch that our youth pay very little regard to the testimony of their fathers, when informed by them that they have seen ships sail on the spot which is at present good pasture land.

Since my remembrance another island is formed near a mile in length, having at present much grass upon it, and which I believe will in a few years be united with the former. Not far from the north end of this last island the great river was separated into three small ones; the first divided Burnham and Berrow Strand from a large track of sand called the Gore; the second divided the Gore from a less quantity of sand, called the Lark-sands; and the third divided the Lark-sands from the Start-Point. This last is almost filled with sand and slub: the second river is widened, and is now the only one in which ships pass; for the first river is so much stopped up, that the Gore-sands are now united with Burnham and Berrow-Point, and our fishermen inform me, that, with the assistance of their slime-carts, they can go near ten miles strait west into St. George's Channel at dead low water, when the tide is run out the lowest possible.

Query,

by which means it is saturated with strong salts of an alkaline nature, and should therefore be thrown over the land immediately whilst wet; for if permitted to dry, the saline particles with which this sand is impregnated by the sea water, will evaporate, and consequently the sand lose the chief ingredient in its composition. Being disappointed in the article of sea sand, the four acres of land were levelled upon the former plan; and soon after about 150 load of 30 cwt. each of dry sand and dung, well mixed and turned, were spread over it, and this made such an effectual improvement, that it was very soon let to a tenant for twenty-one years, at 5l. per annum, neat, clear of all disbursements whatever. The term was expired three years since, and I have now let it at 6l. per annum, but it is worth more.

In the year 1753 one Mr. Mapstone, a gentleman from London, waited on my father at Isleport farm, offering to sell him 120 acres of land in Burnham, called the Henley Estate. My father declined the

Query, Who is the philanthropic Captain, or rather Master, of one of the Bridgewater or other traders, that will be prevailed upon to publish a full and true description of this Channel, in order to prevent strangers from suffering shipwreck on this large and extensive tract of flat sand, the dread scourge of the unfortunate in the hands of pillagers on an inhospitable coast!

proposal;

proposal; I was not of age, but I pointed out to my mother's brother the advantages that would arise from closing in with this offer, in such persuasive terms, that after much deliberation he was prevailed on to become a purchaser at 1600l. The estate then let at 80l. per annum, but did not clear quite 50l. upon an average. Here was a large field open for industry, and my uncle prosecuted it to such good effect, according to examples I have already laid down, that in a very few years this farm was increased to treble its value when purchased, and is at present worth, if it was to be sold, upwards of 5000l.

In the year 1757 I purchased a farm of Marsh Dickenson, esq; then Lord-Mayor of London, which had for years been offered for sale, and which every person was either unable or unwilling to buy. Part of this land consisted of six acres in one close so exceeding poor that I was glad to let it by itself at 40s. per annum. This however did not last long, for I added to my former method of hauling the banks into the low parts to make it plain and dry, several good dressings with rotten dung and good bank earth, mixed into a compost by two turnings, and this did the business; for I immediately let it to a tenant for a term of fourteen years, at 10l. per annum. The term hath been expired
for

for many years, and I have since added it to a farm, but it is worth at present 12l. per annum.

I have made other improvements and experiments upon meadow land that have come very near to, but none that have exceeded, those already related. One thing I think worth remarking, viz. in the year 1759 I was solicited to purchase sixty-one acres of land in Burnham at 200l.; and this estate hath since been so much improved, that I would now be glad to contract for the fee of it at 2000l. Indeed, since this time, various estates, to the amount of a great many hundreds per annum, have been purchased of persons at a distance, by the inhabitants of Burnham, who have improved them much after the same manner, and who at present live very comfortably upon them.

As one great proof of the advantages arising from this mode of improving estates, the inhabitants of Burnham are at present owners of upwards of 1000l. per annum in other parishes, although I remember when no man in the parish (my grandfather excepted) was worth 1000l.— There were then but five jurors and freeholders in it, whereas at present we have fifteen returned to the county sessions as gentlemen, thereby qualifying them to serve on the grand inquest of Somersetshire;

shire; and are worth from 2000l. to 10,000l. a man. We have, exclusive of the above, fourteen other farmers with estates sufficient to qualify them as jurors to serve upon Nisi-prius juries; and have in the whole thirty-six freeholders, besides six widow women farmers, worth 1000l. each upon an average.

You are not to suppose that no other parish besides Burnham hath received benefit from this mode of husbandry, viz. first making the land entirely plain and level; and secondly, keeping it perfectly dry by guttering; for the whole flat country I described in my last letter feels its good effects, more or less; but judging from the new-acquired riches of the inhabitants in general, I conclude no other parish hath, in the same number of years, exceeded, if equalled, the place of my nativity. However, I will here take the opportunity of introducing a few hundred acres lying in the parish of Mere, a great part of which I remember about forty years since was rented by a capital farmer and judicious grazier called Esgar, at 1s. per acre; and some other parts were rented by sundry other farmers, from 2s. to 5s. per acre. Mr. Esgar purchased a large tract of this land in fee simple, and, according to the report of the day, *at twenty shillings per acre*. He immediately began to exert himself in making this land

lye plain and dry, his neighbours followed his example, and without the assistance of any ashes, dung, foil, or compost of any kind whatever, part of these lands have been sold at about 40l. per acre; and many hundreds per annum, the remainder, are at present worth 40s. per acre per annum, and now owned and occupied by Edward Brown and Arthur Phippen, esqrs. and several others.

I have hitherto treated of the improvement of meadow land, as it ought to be practised by the owners; the expence of which, together with the temporary loss of the herbage, being too much to be suffered by the tenant. I shall now proceed to treat of the improvement of meadow land in the way it might be performed by tenants at will, or occupiers of land, independent of any expectation of ownership, or certainty of continuing the possession, supposing the landlord cannot be prevailed on to contribute towards the expence. In speaking to this part of my subject, I shall beg leave to state the methods I have practised myself in improving such meadow lands as I have formerly rented.

Let, for example, the piece be two meads of five acres each, without any division, having high banks all round and lowest in the middle. I take possession at *Lady-Day*, and immediately divide the
close

close into four equal parts, by cutting two cross gutters quite through into the ditches. Let these gutters be eighteen inches deep and only ten inches wide, the wages is one penny per rope (of twenty feet) for cutting, and one penny per rope for spreading about the earth, making it fine, and getting it into the ground; the whole, being sixty-three ropes, will amount to half-a-guinea; and this is all the expence the first year, for I indulge my workmen or some other labourers (enough of whom are always to be found) with the privilege of planting potatoes in so much of the bank in each quarter as I guess will amount to fifty put-loads, making in the whole two hundred loads. These potatoes I order to be taken up about *Michaelmas*, or sooner if I want to stock the field; and that the potatoe labourer may dig the bank quite to the bottom, and throw it round together in a high narrow ridge, I give him one shilling a quarter, that is, four shillings for the whole. If I want to mow the field the second year, I then carry out these four potatoe-banks in the frost; but if I do not want to mow the field, I prefer the covering it in the month of May to any other season of the year. The bill for doing this will stand thus:

	£.	s.	d.
To hauling 200 loads of bank-earth, ten days,			
at 1s. 6d. per day - - - - -	0	15	0
To the hire of a put and one horse, ditto, at			
2s. 6d. per day - - - - -	1	5	0
P 2			

	<i>£.</i>	<i>s.</i>	<i>d.</i>
To spreading about the earth, and beating it small, ten days, at 1s. 6d. - - - - -	0	15	0
To hauling the earth-drag* over it twice, two days' work - - - - -	0	4	0
To the potatoe labourer for turning and me- liorating the bank - - - - -	0	4	0
	£.3		3 0

Let this ten acres be thus dressed every second year till all the banks are carried over the field; and whether it be sooner or later, we can but add in the mean time one guinea and a half a year to the rent; and the only question for the tenant's consideration will then be, whether the ten acres have

* These drags ought to be made after the following manner:— Take five pieces of elm, ash, or any other timber, seven feet long, and sawed to such a scantling that each end may alike form a scalenum triangle, whose longest side is nine inches, shortest side five inches, and middle side seven inches. Let these five pieces be framed together with five strong oak rails, each seven feet long, in the manner of a harrow. This new implement now becomes an earth-drag, seven feet square. If the earth be mellow, haul that side forward which has the greatest bevel, and this side will slide the lightest. If the clods be large and rough, haul the side forward that has the least bevel. If the earth be almost small enough, turn the drag upside down, and haul the roundest edge forward; but if this drag be wanted to plain the land for mowing, haul the keen edge forward, always remembering to keep the wearing places well plated with flat hoghead hoop iron. It should be observed, that a great farmer ought to have three of these drags, one of six feet square made light, one of seven feet square above described, and one of eight feet square made strong with pieces of a larger scantling.

produced

produced a ton of hay per annum extraordinary on account of any one or more of those dressings; if so, the tenant is fully paid; but if it has not, there must be some fault in performing the labour.— However, if it should have produced from one to ten tons a year, in addition to the usual crop, on account of these repeated dressings, it will be an ample profit for the tenant, abstracted from the advantage arising to the landlord in improving the fee.

When all the bank-earth is compleatly finished carrying about the land, I then, and not till then, proceed to gutter this field all over, beginning exactly thirty-three feet from the straightest side, and so let each gutter be thirty-three feet from the other, till the whole is finished. I usually have but one draught gutter, and am always directed in a wet season by the height of the water where to fix it; but it very seldom makes any difference in this level country, and in that case I prefer the middle of the field. The reason why I am so particular with regard to the exact distance of thirty-three feet, is, because it is half a chain, and is fully sufficient for a row or parcel of green hay; besides, I can form a judgment as to the quantity of labour performed, according to the length of the field; for if it be five chains long, the plot between the

gutters will be one rood; but if ten chains long, then half an acre, and so in proportion. Formerly these gutters were dug twenty inches wide, and but one foot deep; this was a bad method, for to say nothing of the great loss of land, the cattle were continually treading down the edge of the gutter and filling it; whereas, if the gutter be twenty inches deep and but ten inches wide, the land will swell and press itself almost together on the top, so that the cattle may easily pass over the gutter, which will continue its breadth at the bottom, and thereby stand many years, and answer the purposes for which it was intended.

By the time the whole of the old banks are carried over the land, the digging of the ditches in a ten-acre field will always produce a sufficient bank for dressing, and if it should not, the digging up the old gutters will supply the deficiency. This example will apply to all kind of wet meadow lands, with high banks; but where there are no banks about the fields, I have recourse to the making of compost manure upon the corners of the commons and lanes nearest the land I intend to improve.

In a journey to London, anno 1758, I observed upon a sign in the road these words: "Peat-ashes sold here." The meaning of this I could not comprehend,

prehend, having always hitherto looked upon our peat-ashes to be of no value: I therefore made every necessary enquiry, and soon after my return home built a place to keep peat-ashes dry, and in May or June I had them sown over some poor land, after the rate of four put-loads to an acre, and I suppose in the course of a week it could be discovered to an inch how far they were sown: nay, I have made one piece of three acres so rich by this method, that I will defy the most skilful agriculturist to make it richer. Farmers who keep large fires, and burn nothing but peat, (for there is very little beside burnt in this country) will soon have a quantity sufficient to try an experiment. With regard to a great variety of manures recommended by writers on agriculture, however good in theory, they cannot be of much utility in point of practice. Lime with us is 20s. a load, and of no use to meadow land, unless mixed with sand or peat-ashes. Soaper's ashes is a tried manure, but we have no soap-boiler between Axbridge, Glastonbury, Bridgewater and the sea, a circuit of fifty miles. Wood ashes, however valuable as a manure, is worth from 1s. to 1s. 6d. per bushel for another use. Indeed, the mentioning of foot, salt, rags, leather, saw-dust, malt-dust, fish-shells, bones powdered, and articles of like kind, as useful manure,

(except

(except in large towns and cities) appears as an imposition on our understanding. It is true, peat-ashes kept dry is an excellent manure, yet although I have turbary of my own sufficient to produce twenty waggon-loads of turf in a year, I have never been able to enrich more than six acres of land with this manure since I have kept a farm.

I would not be understood to mean, that meadow land thus improved cannot be reduced to its original state of poverty, for I know to the contrary, having tried an experiment upon twelve acres of meadow which have been in my occupation between thirty and forty years. The original rent was 9l. per annum; and having a lease upon it, I improved it in the manner here stated, till it produced me a ton and a half, and some years two tons of hay an acre. The rent was then raised to 18l. per annum, when I immediately began to work it backwards by mowing it every year (sometimes very late) and hauling off the hay, letting the gutters fill, and the banks and ant-hills increase, so that half a ton an acre is not reckoned in its present state a bad crop; the rent must therefore, in a few years, be abated to 9l. a year as formerly.

I beg leave to suggest an observation in this place that is worthy the attention of the agriculturist, as
 applied

applied to this country; it is to make use of every proper method to get meadow land covered with grafs as early as possible in the spring; for if so, the abundance of dews which fall at that season of the year upon the leaves of the grafs, will be conveyed through the vessels to the roots, and the sun's rays promoting the motion of the juices, will contribute to make it vegetate, even if we should have a scarcity of rain; whereas if the land be fed bare in April and May, the increasing heat of the sun will exhale the circulating juices from the roots of the short grafs upon barren land, so as to dry them up, and cause them to stagnate for want of moisture; from hence I conclude, that if the meadow be covered over in the frost, and the earth well husbanded so as to nourish the tender roots of the grafs, it will cause it to vegetate so much the earlier in the spring, as to cover the ground before the sun's rays can act so powerfully as to scorch it up; in which case it will in a dry summer grow double the quantity of hay it would have had on it without such dressing. However, landlords should dress their lands in the summer as already recommended.

I do not in general like the rolling of meadow, our heavy clay soil being close enough without it; besides, the roller will press the loose clods of earth
into

into the land, where it will lie like a stone; but if it had been permitted to remain on the top of the sward, the sun, wind, and rain, would have meliorated the lumps so as to flait abroad like a limestone; and being thus divided into small particles, it would of its own accord (at least assisted by the earth-drag) incorporate with the land, and promote vegetation. However, if a close of meadow hath been much trod by cattle, it certainly ought to be rolled, (if but for the reason of close mowing and feeding) but it should be done at a particular point of time; for it is possible in the morning it may be so wet as to clog the roller, and the land may become pressed into pits; yet a twelve-hours hard dry March wind, assisted by a scorching May sun, will make the land so stiff that it must be a heavy roller to make it smooth.

When meadow land abounds with moss, as is sometimes the case, and the farmer hath no opportunity to tread it well with cattle by feeding them upon it in the winter or spring, I then recommend the spike-roller as the best method of destroying it next to such treading; but in this case there ought to be sown some white clover or other grass-seeds about the field; if in small rain, the better it will be beaten into the pits made by the roller; but

but whosoever will use the spike-roller should feed all their house-cattle upon strong wires with drawers underneath to catch the seeds, which should be sown over the meadows against rain, in preference to clover or any other feed. I have had some thoughts of watering the meadows thus rolled with barton drainings and thick water, by a water-cart of a new construction, in somewhat the same manner as the streets of London are watered; but having let my farm to a tenant, I shall not now make the experiment.

Whoever will take the trouble to number the different sorts of plants and grass growing in one of our meadows, will find them to be from one hundred to one hundred and fifty. I can find names for, and investigate the properties of some of these; but as I cannot of all, I am content to be silent on that subject, lamenting that I have been so circumstanced in life as never to have had an opportunity to sit a month at the feet of Linnæus, or any other able botanist. However, I mean to transplant these into so many different pans filled with the same soil and buried in my garden, in order to observe, from time to time, the different qualities of the different plants, in all the different stages of their growth.

: I appre-

I apprehend that the mode of improving meadow land, as here laid down, will equally apply to the fens of Cambridgeshire, the flat part of Lincolnshire, and the low meadows bordering upon the Thames, the Trent, and some other great rivers. I have travelled in those counties, and observed their method of husbandry to differ greatly from what I have practised with good success, for in general they dig their gutters crooked and without any order. I have expressed my sentiments very freely to some of the farmers in Lincolnshire, Nottinghamshire, Leicestershire, and some other counties, who will not be persuaded but their best lands exceed in richness those of the Northern and Western parts of England; yet I do not recollect any large farms in the Eastern counties, which lie at a distance from market-towns, that exceed 30s. an acre per annum upon an average; whereas our farmers can well afford to pay 40s. an acre, statute measure, for all those lands that are brought into the highest degree of culture; and several thousand acres in this county are now let at 50s. per acre, landlord paying all disbursements.

Some years since I let a farm to a poor man, who desired an account of his profit and loss might be kept by his neighbour, Mr. John Adams, who, about seven o'clock in the evening of the 19th of August

August 1784, was robbed and murdered by two footpads, being shot through the body. The memorandum found amongst his papers is in substance as follows:

“ 25 March, 1771, Robert Hardwidge rented of Mr. Locke, Goosemore-farm, being fifty-six acres, at 9l. per annum. Tenant had two cows of his own, and rented fourteen cows of his landlord at 14l. per annum.

Cash, Debtor.

	£.	s.	d.
To rent of the farm - - - -	91	0	0
To the hire of fourteen cows - -	14	0	0
To ten pigs bought poor - - -	10	0	0
To house-keeping for two, exclusive of the farm beverage - - - }	8	0	0
To cash in house - - - - -	40	0	0
	<hr/>		
	£.163	0	0

Per Contra, Creditor.

	£.	s.	d.
By 56 cwt. of cheefe, at 1l. 12s. 6d.	91	0	0
By sixteen calves fold - - - -	16	0	0
By the whole year's butter - - -	16	0	0
By ten pigs fold fat - - - - -	26	0	0
By wintering forty ewes - - -	14	0	0
	<hr/>		
	£.163	0	0

The tenant was twelve years upon this farm; the first five he acquired 250l. at the end of which he became

became a convert to Mr. Madan's doctrine of polygamy, and spent in seven years his whole property.

I lay it down as a rule, that a Dairy-farm of 200l. per annum ought to keep thirty-two cows, four heifer yearlings, four two-years-old heifers, two carting brood mares with two sucking colts, two yearling colts, two fat oxen, and sixty ewes, at winter. I know a farm of this kind that adjoins a turnpike-road, and consists of a mansion, garden, and necessary out-buildings, with about an acre of orchard, which commonly makes in good years twenty hog-heads of cyder, and one hundred acres, statute measure, of excellent rich land, laid out as follows:

		40 Chains.				Acres.
26 Chains.	A 25	—	H 2	G 3	F 5	A. Higher Ham Pasture - - 25
	B 25	C 20			E 10	B. Lower Ham Pasture - - 25
					D 10	C. Long Mead - 20 D. Lower Mead - 10 E. Higher Mead - 10 F. Oxen Ham - 5 G. Calves Close - 3 H. Horse Paddock - 2
						100

Landlord to pay all taxes, repair the buildings and outbounds, and keep fenced the fir-trees and hedges round the farm. Tenant to dig the inclosures, pay the tithe, repair the highways, and keep the farm in a good state of culture.

One

One year's account of the tenant upon this farm is stated thus :

Cash, Debtor.

	£.	s.	d.
To one year's rent - - - -	200	0	0
To house-keeping for six, exclusive of the produce of the farm - - - -	20	0	0
To wages to two men and two maid-servants	20	0	0
To two oxen, bought for the plow and grazing	18	0	0
To sixteen pigs, bought poor - - -	16	0	0
To wear and tear of dairy-utensils, and expences about ditto - - -	8	0	0
To ditto of goods and farming utensils -	8	0	0
To tithes, at 1s. per acre - - -	5	0	0
To clothes, and other necessaries - -	8	0	0
To cash in house - - - -	100	0	0
	<hr/>		
	£.400	0	0

Per Contra, Creditor.

By 112 cwt. cheese (being 3½ cwt. each cow) at 1l. 16s. per cwt. - - - -	£.	s.	d.
	199	12	0
By the whole year's butter (kept by itself)	30	0	0
By 28 calves fold (4 of the best preserved to breed)	28	0	0
By 8 pigs, fold fat (the other 8 killed in house)	24	0	0
By bacon fold - - - -	7	8	0
By 2 oxen, fold fat - - - -	26	0	0
By 4 cows, fold fat (succeeded by 4 heifers)	24	0	0
By 2 coaching colts, 2 years old (succeeded by 2 yearlings) - - - -	40	0	0
By wintering 60 ewes - - - -	21	0	0
	<hr/>		
	£.400	0	0
Turkeys, geese, ducks, and other poultry, in lieu of pin-money.			As

As this is a Dairy farm without any tillage, the tenant, with two able-bodied men servants, are quite sufficient to manage the business of it in all its branches.

The only probable objection that can be raised against this account, will be founded on a doubt whether $3\frac{1}{2}$ cwt. of cheese at 1l. 16s. per cwt. may not be too much for an average quantity per cow, and price per cwt. In answer to which, if the Bath Agriculture Society should think proper to offer any trifling premium in order to discover the fact, I could produce one Jacob Amesbury, a dairy farmer, now living at Bleadon in the county of Somerset, who from twenty cows, summer fed on twenty-five acres of rich land, made 90 cwt. of cheese the year past, which cheese was sold to a Mr. Carter, factor, in Bristol, at 2l. 4s. per cwt. and one guinea over, amounting together to the sum of 199l. 1s. which is near 10l. per cow, upon an average, for cheese only.

I will very readily answer any questions by way of explaining any thing doubtful, either in this or my former letter descriptive of the flat part of Somersetshire.

I am, dear Sir, your most obedient

And obliged humble servant,

R. LOCKE.

ARTICLE XIV.

On the Use of Plaister of Paris as a Manure.

[By J. KIRKPATRICK, esq; to the Secretary.]

St. Cross, Isle of Wight, Dec. 2, 1789.

SIR,

I Have not had the pleasure to address myself to you for some time. It was my intention before this (agreeably to the desire of the Society) to have collected some particulars of the agriculture of this island, but my ill state of health prevented me; and for which, being advised to take a voyage at sea, curiosity led me to visit the United States of America; great part of the Northern provinces, and Canada, I have therefore travelled through this summer; and, among other objects which engaged my attention, agriculture was not forgotten. The letter, of which you have a copy inclosed, I met with at Philadelphia; the subject struck me at the time of reading it as worthy of attention, and more so after I had seen some land on which the plan recommended had been tried. The cheapness and efficacy of the Plaister of Paris makes it much used in the States; and if, by the recommendation of the Society, any experiments are made, and it is found

to answer the account given of it, I shall be happy in having been the means of furnishing the Society with this account.

The only thing which makes me doubt its being brought into general use, is the price, which in this place is 8s. per bushel, owing to the very high duty on that imported from France. At Philadelphia it is sold, ready prepared for sowing, at 5s. per bushel, their currency, which is 7s. 6d. per dollar.

I have been informed, that large quantities of it are to be got in the neighbourhood of Liverpool, which I suppose would be free of the duty, and consequently come much cheaper.

Wishing every possible success to the Society,

I am, your most obedient servant,

JOSEPH KIRKPATRICK.

*Extract of a Letter from a Gentleman in Pennsylvania,
to Joseph Kirkpatrick, esq.*

“ In answer to your queries respecting *Gypsum*, or *Plaster of Paris*, I shall give as full information as I can of the success of my own and my neighbours' experiments.

“ The

“ The best kind is imported from hills in the vicinity of Paris: it is brought down the Seine, and exported from Havre-de-Grace. I am informed there are large beds of it in the Bay of Fundy, some of which I have seen nearly as good as that from France; nevertheless, several cargoes brought from thence to Philadelphia have been used without effect. It is probable this was taken from the top of the ground, and by the influence of the sun and atmosphere dispossessed of the qualities necessary for the purposes of vegetation. The lumps, composed of flat shining specula, are preferred to those which are formed of round particles like sand; the simple method of finding out the quality is to pulverize some, and put it dry into an iron pot over the fire, when that which is good will soon boil, and great quantities of the fixed air escape by ebullition.

“ It is pulverized by first putting it in a stamping-mill. The finer its pulverization the better, as it will thereby be more generally diffused.

“ It is best to sow it in a wet day. The most approved quantity for grass is six bushels per acre. No art is required in sowing it, more than making the distribution as equal as possible on the sward of grass. It operates altogether as a top manure, and

therefore should not be put on in the spring, until the principal frosts are over, and vegetation hath begun. The general time for sowing with us is in April, May, June, July, August, and even as late as September. Its effects will generally appear in ten or fifteen days; after which the growth of the grafs will be so great as to produce a large burden at the end of six weeks after sowing.

“ It must be sown on dry land, not subject to be overflowed. I have sown it on sand, loam and clay, and it is difficult to say on which it has best answered, although the effect is sooner visible on sand. It has been used as a manure in this State for upwards of twelve years. Its duration may, from the best information I can collect, be estimated from seven to twelve years; for, like other manure, its continuance very much depends on the nature of the soil on which it is placed.

“ One of my neighbours sowed some of his grafs ground six years ago; another four years ago; a great part of my own farm was sown in May 1788. We regularly mow two crops, and pasture in autumn; no appearance of failure, the present crop being full as good as any preceding. I have this season mowed fifty acres of red clover, timothy grafs, white clover, &c. which was plaistered last
 May,

May, July, and September; many who saw the grafs estimated the produce at two tons per acre, but I calculate the two crops at three tons. Several strips were left in the different fields without plaister; these were in a measure unproductive, being scarce worth mowing.

“ In April 1788, I covered a piece of grafs land upwards of two inches thick with barn manure; in the same worn-out field I sowed plaister, to contrast it with the dung. I mowed the dunged and plaistered land twice last year, and once this; in every crop the plaister has produced the most.

“ You will remember, in all experiments with clover, to mix about one-third timothy grafs seed; it is of great advantage in serving as a support for the clover; it very much facilitates the curing of clover, and when cured is a superior fodder,

“ The plaister operates equally as well on the other grasses as on clover. Its effect is said to be good on wheat, if sown in the spring; but I cannot say this from experience. On Indian corn I know its operation to be great; we use it at the rate of a table-spoonful for a hill, put in immediately after dressing,

“ From some accurate experiments, last year, made and reported to our Agricultural Society, it appears that nine bushels of additional corn per acre were produced by this method of using plaister.

“ As the use of this cheap and extraordinary manure has now become very general in this State, and many accurate and judicious farmers are now making experiments therewith, I doubt not but its uses, at the close of the season, will be better known and further extended; when I shall be happy to make a communication thereof to you.

“ I am, &c. &c.”

ARTICLE XV.

An Account of an Experiment actually made to discover whether whole Potatoes or Cuttings are to be preferred in planting, &c.

[By Mr. JOSEPH WIMPEY.]

EARLY in the spring of this year I had a large quantity of potatoes, out of which I selected forty-eight bushels of the fairest for sets. The ground

ground intended for them, the summer before, had borne oats and vetches, which were mowed green, and given to the horses in the stable; after which it was depastured till January. It was then clean ploughed, and lay till the end of March. Twenty-four cart-loads of long dung, forty bushels to the load, were then spread over it equally. Furrows were then drawn the length way of the field, at a yard distance from each other. In eleven of these furrows, containing sixty perch or pole, were dropped fourteen bushels of whole or uncut potatoes, the size generally from a large pullet's egg to that of a goose. The remainder of the ground, being 265 poles, making in the whole 325 pole, or two statute acres and five pole, was planted with thirty-four bushels of cut potatoes, being the remainder of the forty-eight bushels. These were cut mostly out of large potatoes, in pieces about the size of a large pullet's egg. The largest were cut into six or eight pieces, the lesser into four; being careful to preserve a proper number of eyes or buds in each cutting. The sets of both cut and uncut were planted about fourteen inches asunder, in the rows. The furrows were turned out with a plough having a double mould-board, which, when planted, were compleatly covered by running the same plough up the middle of each interval, which threw the mould

half

half one way and half the other, and is the speediest, easiest, and cheapest method of planting I am acquainted with. The ground was planted the 14th and 15th days of April last.

In June they were horse-hoed with a small one-wheel plough, which I keep for horse-hoeing; and this was all the labour and expence bestowed upon them during their growth.

The 30th of October the taking of them up was completed. The whole produce was only 378 bushels;—a very indifferent crop! little more than half the acreable produce of last year. The expence of ploughing them up, harrowing, dragging, picking up, loading, carrying home about a quarter of a mile, unloading, and carrying into the barn, &c. was not quite 3d. a bag, or 1d. a bushel. The state of the account, in a comparative view, I make out as follows:

The measure of all the ground planted was 325 poles. The whole produce 378 bushels. The measure of the ground planted with *cut* potatoes was 265 poles; the produce 312 bushels. The ground planted with whole or *uncut* sets was 60 pole, and the produce of the same 66 bushels.

Now,

Now, if 325 poles, the whole measure of the ground planted, produced 378 bushels, then 265 poles should produce 308 bushels, (I omit the fractions) but this quantity of ground planted with cut potatoes) produced four bushels more nearly, that is, 312 bushels. Again, as 325 poles produced 378 bushels, then 60 poles should have produced 69 bushels and a fraction; but it produced only 66 bushels, which is upwards of three bushels short of its proportion. It is true the difference is too trivial to be worthy of notice; but what it is, is in favour of the cut potatoes. With respect to the acreable produce, then, it is a matter of little importance whether the ground be planted with *cut* or *uncut* potatoes.

The acreable produce being nearly the same, whether planted with whole or cut potatoes, the great and interesting comparative question remains, viz. What is the difference of the expence in the planting of cut or uncut potatoes? which is very satisfactorily ascertained as follows:

If 48 bushels, the whole quantity of sets used, produced 378 bushels, then 34 bushels, the quantity cut, should produce 267 bushels; but they produced 312, which is 45 bushels more than the proportion. Again, If 48 bushels produced 378 bushels,

bushels, then 14 bushels should have produced 110 bushels; but 14 bushels of uncut produced only 65 bushels, which is 44 bushels less than the proportion. A preference of 40 per cent. in favour of cut potatoes, in comparison with whole sets!

By this statement it clearly appears, that any quantity of land planted with potatoes cut into pieces of the size above-mentioned, will, *ceteris paribus*, produce as great a crop as an equal quantity of land planted with *uncut* potatoes, the weight of which should be 40 per cent. more: for example,

To plant a statute acre with potatoes as above, would require of uncut $37\frac{1}{3}$ bushels; of cut only $20\frac{1}{2}$ bushels, the difference nearly 17 bushels; which at 2s. 4d. per bushel, the price they sold at in March and April last, amounts to 1l. 19s. 8d. an object much too considerable to be neglected by the planter of many acres, even when the price may be as low as 3s. a sack.

N. B. Potatoes in this county are usually sold by the bag. By a bag is understood a sack which will hold four bushels of corn, 9-gallon measure, which they fill as full as they can to admit of its being tied; and the usual weight is 12 score or 240lb. This sack holds 3 bushels of potatoes heaped.

The

The foregoing experiment was conducted with all imaginable care and precision, the facts are truly stated, and the writer hopes the calculations are just.

P. S. In class 3, article 4, a premium is offered to the inventor of the best new-constructed plough for ploughing up potatoe-crops, by which the work may be done with the least loss or damage to the crop. As my method of taking up potatoe-crops is not attended with the least loss or damage, and is, I conceive, as expeditious and as little expensive as can be desired, I request leave to lay it before the Society.

As observed before, I plant my potatoes in rows with intervals of about three feet, for the convenience of horse-hoeing them. When the haulm is decayed, I proceed to take them up in the following manner:—With a common foot or one-wheel plough, much used in this part of Hants, and in Wilts; the ploughman having *first taken out the coulter*, and adjusted the wheel so as that the point of the share may be deep enough to pass under the bed of potatoes, he begins at one end just under the middle of a row, and with one furrow turns them out on the surface of the ground. Two or three boys or girls follow the plough, and pick them up as they appear; so that the ground of one row is cleared

cleared before the ploughman has finished another, and thus they proceed without the least hindrance or interruption to each other.

When the whole is ploughed and picked in this manner, a pair of drags is run over the whole, which separates and exposes the potatoes that may happen to adhere to the clods of earth, which are then also picked up and the grounds nearly cleared. The season being now come for sowing wheat, the ground is clean ploughed, and the few potatoes that may possibly remain fully exposed to view, which being also picked, the ground is rendered very clean.—In this way the whole expence of harvesting the crop is little more than picking and carrying home; for the expence of ploughing, &c. is little, if any, more than would have been incurred in tilling the ground equally well for the wheat crop.

Now I think it impossible, by any invention or device whatever, to take up a potatoe-crop with less loss or damage. The crop of the above experiment was taken up under my own eye, and I with great truth and confidence aver, that there were not so many as a single gallon bruised, cut, or damaged in the least degree whatever.

North-Beckhampton,

1789.

ARTICLE

ARTICLE XVI.

On the Rotation of Crops;—the Advantage of Carrots as a Food for Cattle, &c.

Stifted-Hall, near Braintree,

Nov. 25, 1788.

SIR,

I Should be happy, by some agricultural communication, to acknowledge the honour of your application to me from the Bath Society: but, on so small a scale of arable land as mine, kept more for family convenience than amusement, where a regular course is followed, not an experiment tried, nor an improved instrument used; scarcely any thing but tiresome repetition can be sent, or what is known by general experience, uselessly confirmed. I have *twice* gone over on my *four* arable fields in the following rotation of crops, with only *one* plowing for each crop:—Oats, with rye-grass, the grass *sprinkled* with dung and earth mixed in the winter, and *constantly* fed till the succeeding autumn; then wheat; next, the *small* forward Spanish bean, planted in two rows, on four furrows, and *three* times hand-hoed; after these oats, &c. again. I am convinced with such *hoeing*, *manure*, and *feeding*, this very simple course of crops may be followed as productive, for two rotations;

at

at the third, a fallow to me seems *essential*, in the room of the beans; as no *hand-hoeing* with us keeps the soil in sufficient purity for any *longer* term, without a *complete year's* fallowing. On this fallow, in the next year, barley, as more valuable than oats, should be sown, with rye or any other grafs, clover, or trefoil; and then the old rotation, with *one* ploughing, come forward again. I am satisfied any fallow might be avoided, though I doubt whether with any equivalent advantage, if more ploughings were afforded towards throwing the wheat-stubble into ridges of four furrows, planting *two* rows of beans on *each* ridge, hand-hoeing these three times, the hoer always *walking in* the furrow, and drawing his weeds *there*, and then ploughing these furrows up again to the ridge, with a double-breasted plough and one horse. The imperfection of our hoeing, expensive as it is, (for three times hoeing my beans come to 13s. per acre) arises, in some degree, from the labourer *following* his hoe, and at every step treading in the weed it has removed; which must be the case in flat work, whether, at *only one ploughing*, the land be thrown into fatches, (beds) as with us, of eight, twelve, or sixteen furrows. But on the *ridge of four* furrows, this notorious inconvenience is, as I have observed, avoided; the furrow is the path for the hoer and
the

the place for the weeds; from which they are *again* displaced and prevented rooting at *every* hoeing, by the double-breasted plough.

About an acre, in the above rotation, of my bean-field, I have applied, as a winter vegetable, to carrots. The product, with so little ploughing and no manure, has been, on an average, only about 400 bushels per acre. I am however sensible they will amply repay every expence of the *finest* culture; and should, from their extensive utility, on sound, deep, and friable land, be every where attempted. Mine, in general, is far from being their proper soil. I sow in March, or April; hoe three times; harrow after each hoeing; have sometimes left them in the land till after Christmas, and taken them up as wanted; but lately have taken them up in October, in dry days, put them directly into small *upright* cocks of ten bushels each, *entirely* covered, with the tops cut off; they *thus* appear to dry better than in any other mode; and, with very little loss, to bear the weather. If, after being thus dried, they are carried into any barn, or shed, it will be better, if in large quantities, through the hazard of heating, not to pack them *close*, but rather throw them promiscuously into *heaps*, with a little straw over them. Some of my neighbours, who have been induced by me to try them, *on a rather larger scale*, with
finer

finer culture, and *fresh*er soil, have raised from six to nine hundred bushels per acre, and applied them more profitably, as well as more generally, than any other winter herbage, to deer, sheep, bullocks, cows, and horses. At the lowest calculation they are, from our little trials, esteemed to exceed turnips in value one-third, as to quantity of feed; but are far superior in what arises from convenience. For the stable, where to *us* they seem to be a perfect substitute of corn for all horses, at least not used in any quick work; and partially so, with corn, for those that are.

The comparison (tilths for each alike) betwixt the produce and value of an acre of oats, and one of carrots, one bushel of the latter presumed equal to one peck of the former; and each estimated at six-pence, will, I conjecture, stand thus:

One Acre of Oats, Dr.

	£.	s.	d.
Seed, four bushels - - - -	0	8	0
Mowing - - - -	0	2	0
	0 10 0		

Per Contra, Cr.

Five quarters of oats, at 16s. per quarter, being 160 pecks, at 6d. per peck -	4	0	0
Deduct -	0	10	0
	3 10 0		

One

One Acre of Carrots, Dr.

	£.	s.	d.
Seed, eight pounds - - - -	0	8	0
Hoeings thrice - - - -	1	10	0
Harrowings - - - -	0	3	0
Digging up, gathering, and cocking, at 1d. per bushel, 400 bushels - -	1	13	4
	<hr/>		
	£.3	14	4

Per Contra, Cr.

	£.	s.	d.
400 bushels of carrots, at 6d. per bushel	10	0	0
Deduct -	3	14	4
	<hr/>		
Net profit -	6	5	8
Net profit oats -	3	10	0
	<hr/>		
Excess on carrots	£.2	15	8

When perfectly dry, no washing of the carrots is, in general, necessary for any cattle, except horses regularly kept in the stable. This is undoubtedly a little additional trouble and expence. We sow in March. If the weather continue dry, it will be some weeks before this plant appears, and so *very delicate*, as to make the first hoeing, or rather weeding, which must be as early as their strength admits, extremely tedious and troublesome. In about a fortnight their root will be sufficiently fixed to bear harrowing, by which their growth will be promoted, and the land cleaned; and the treading of the horses will not hurt the plants. In about a

fortnight more the second hoeing, to set them out at six inches square, will follow, and a second harrowing; the third, if at all necessary, just as the state of the soil and growth of weeds may require; for as to the carrots, their nourishment is drawn from a bed so much deeper than that of weeds, as not to be at all injured in their progress, though disgraced in their appearance, by such company.

Such are my trivial attempts, on a few acres in agriculture:—To the adventurers in it, *on a large scale*, I look up with somewhat of veneration, as the best subjects of the state, and the first friends of man; but which, in this kingdom, as the source of all *permanent* manufacture, and fair commerce, instead of receiving every political encouragement, is burthened with every oppression that the spirit of monopoly can devise, the cunning of trade demand, and the interest of corruption support; and consequently the large capitals seduced into every speculation and pursuit, except that which promises an ampler and surer, though slower return, and far more congenial with that habit of patient industry, and exact œconomy, to which alone wealth *should* appertain,—*the perfect cultivation of our soil*.—A fourth, probably, of this Island is nearly waste; wanting only an *encouraged* cultivation to afford employment and comfort to that numerous
 poor,

poor, which the manufacturer rears for the landholder, under a rate of two millions per annum to sustain; and which remains a mark of more barbarous folly in this refined age of *arts, manufactures, and commerce*, than of tyranny in that gross one, when feudal dignity demanded such a range for its savage chace. What does that kingdom merit, that presuming to take the lead in wisdom amongst the nations of the earth, yet, for want of the most obvious exertions of benevolence, in the *publick* encouragement of rural industry, spurns at the very means that Providence offers for its *peaceable* greatness—*at home*;—and madly thinks of gaining power and commerce, and *preserving its freedom*, by squandering wealth and population in the acquirement of dominion—*abroad*;—thus placing itself in a state of constant jealousy and fear with one-half of the world, and counteracting the very advantages of that commerce it would thus violently ensure, by the enormous burthens, essential at all times to guard against, and frequently to support, the wars resulting necessarily from such mistaken policy?

I am, Sir,

Your obedient servant,

CHARLES ONLEY.

ARTICLE XVII.

An Enquiry concerning the Smut in Wheat.

1. *Of its Cause.*
2. *Of the Means of preventing it.*
3. *Of its Remedy.*

MANY are the *nostrums* which are said to be infallible in preventing or remedying this common evil; and many more are the pretenders to choice secrets, which are effectual, certainly, to the same most valuable purpose. But every practical farmer of common observation knows, assuredly, to his sorrow, that in unfavourable seasons none of the boasted means he has used hath ever effectually answered his purpose.

The first step towards the remedying any evil either in the animal or vegetable kingdom, is the true knowledge of its cause; without it, all is quackery, and too often the artifice of designing adventurers, who hope to make a sinister advantage of the weak and credulous, who are too apt to swallow the hook which is covered with a gilded bait. Every one embraces with pleasure what he is persuaded will promote his interest.

The previous question is, what is the *cause* which generally produces the smut in wheat?

To

To this no positive or probable answer has been given. It has been generally supposed, if one may judge by the means commonly used to prevent it, that it proceeds from the seed, whose *stamina*, by some means or other, have been vitiated; for all the means of prevention I ever heard of, were used in the preparation of the seed previous to its being sowed.

The most common method is brining and liming the day before sowing, which is done either with sea-water, the brine of meat, or of sea-salt dissolved in water made strong enough to bear an egg. To this, some whimsical people have capriciously added several ingredients, which are much more likely to destroy the vegetative principle of the seed, than to remedy any evil the rudiments of which might latently subsist in it. To this purpose, flour of brimstone, aloes, copperas, and verdigrease in fine powder, affaëtida, and even arsenick, have been recommended to be infused in the pickle; but this is so very absurd, and even dangerous, that men of sober common sense are both afraid and ashamed of the practice.

The practice of brining and steeping was suggested by accident, established by custom, and continued against all reasonable conviction of its

utility. In unfavourable seasons, every one knows, that smut generally prevails in spite of every precaution that has been hitherto taken. Brine, pickling, liming, change of seed, and seed of one year old and upwards, avail nothing. In cold wet summers the smut prevails, notwithstanding the use of every means which invention hath urged, or ingenuity practised.

The circumstances that first attracted my notice, and engaged my attention to this subject, were as follow:—Some years since I set a ridge with wheat, by way of experiment, in rows at various distances; in the course of the spring it was hoed two or three times, and was as healthy, vigorous, and fine, as ever was seen. In general it was from four to five feet and a half high, the straw uncommonly large and strong, and the ears from four to five inches and a half in length. No corn ever appeared more promising. Thus it continued till the bloom appeared, about the middle of June. The weather then became wet and cold, and frequently deprived the corn of what is usually called its blossoms. Before the end of the month, the ears put on a sickly look, and upon examination, it was found amazingly smutty; more so, indeed, than I had ever observed any before. In vain I examined the roots, the straw, the joints, &c. all appeared sound and perfect,

perfect, till I came to the ear; there the evil began, but from what cause, or by what means, not the least vestige could be found.

As the plants were vigorous, perfectly healthy, and sound, till the bloom appeared, and then turned sickly and distempered, and at length immoderately smutty, it seemed very clearly to follow, that it could not be owing to any imperfection in the seed, but entirely to the inclemency of the air, which by some means or other infected the grain in its embryo-state, and converted the milky substance, which constitutes the meal or flour of the corn, into a black, foetid, unwholesome powder, known by the name of smut.

Strongly impressed with this opinion, I determined to embrace every opportunity of gaining all possible information on the subject. For some two or three years the seasons were favourable, and afforded no opportunity for observation; but 1787 was an unprosperous year, and gave us smutty wheat in abundance. Yet though I was very attentive to its progress after it was discovered, I gained no additional intelligence respecting the cause; but a full confirmation of my former opinion, that the smut was generally, if not totally, caused by the inclement and vitiating principles of the

the

the atmosphere which happened at the time of its blossoming; for till then it was free from every appearance of defect whatever. This, however, did not relax my resolution of endeavouring, by every means in my power, to investigate the true cause; whether it originated from any defect or imperfection in the seed, or was principally owing to a destroying distemperature or blighting principle of the air.

The next year, 1788, was very favourable to the growth and ripening of wheat. The summer was dry and healthy, and the corn sound and good, though the straw very short and scanty. The seed I sowed was of my own saving, of the same year's growth, and sowed on the same land, without any change whatever, yet I had no smutty wheat that year, and therefore no opportunity of making remarks. The next seed time I had a mind to try the white cone wheat, and therefore procured my seed from a different county, and took all the usual precautions to guard against the smut. The seed was perfectly sound and good, yet I had not a ground that was perfectly free from it this year.

Most of my wheat this year was sown in drills at various distances, for the sake of experiments, and was all horse and hand-hoed. In the months of
 April

April and May it was amazingly fine, so as to be the admiration of all that saw it. The farmers in the neighbourhood declared they had never seen any thing equal to it before, for height, size, vigour, strength of stalk, and length of ear. In this flourishing state it continued till above the middle of June. About this time the weather grew cold and stormy, and continued so till towards the end of July, a few fine days intervening. The wheat was now in full bloom, but frequently stripped of it by the hasty showers that fell. Such, however, is the wonderful œconomy of nature, that if wheat be stripped of its bloom by the intemperance of the weather, a fine warm day reinstates it, and the bloom becomes as fair and promising as ever. This I have observed it to do several times in alternate succession; but there is a limit which the return of the blossoms cannot survive, and if it happen before the embryo is duly impregnated, then the kerning or granulating succeeds badly, and at harvest the corn proves defective and smutty.

During the growth of the corn this year (1789) I was very attentive to it from the first appearance of the ear in the side of the stalk to the time of its maturity. Soon after the showery time above-mentioned, I observed a great number of the ears
turned

turned quite brown, as if they were ripe; but upon examination they proved to be abortive ears, without any corn in them; they handled as loose and soft as corn that had been threshed. This circumstance surprized me very much. To see corn, which so short a time before was so very fine and flourishing, prove to be nothing more than chaff, was exceedingly mortifying indeed! I imagined the roots had been destroyed by some insect or reptile; but, upon examination, I found them as found and perfect (as indeed was the whole plant, the ear only excepted) as corn could possibly be.

Soon after this, I observed the south side of one of the finest fields was grown very smutty. It was sufficiently discouraging to see corn five feet high, with ears five or six inches long, and as healthy and vigorous as ever was seen, in a few days converted into smut. This unwelcome circumstance furnished opportunities, more than enough, to exercise the most inquisitive mind in search of the causes of those evils, which blast at once the hopes and expectations of the most sagacious and industrious husbandman. To investigate the cause, I began by examining the roots of the smutty ears, then the stems or straw, the joints, and every part up to the ear, in any of which no defect whatever was

was

was to be found. I had not proceeded far, however, before I observed, that both smutty and sound ears were frequently produced and nourished by the same root, and consequently were both produced from one and the same individual seed. This circumstance alone goes very far towards proving, that the cause of the smut does not exist originally in the seed; for if its *stamina* were vitiated or corrupted, it is not possible to conceive that it should produce plants sound, healthy, and vigorous, for eight or nine months, and then some ears full of corn perfectly sound and good, and others nothing but smut balls.

Not fully satisfied with this, I pursued my intention, and spent much time in examining the smutty ears; I soon discovered it was no very uncommon thing for the same ear to contain both sound and smutty corn.

In some ears the tops were mostly smutty, and the bottoms sound; in others the tops were sound and the bottoms smutty; but more generally, one side of the ear was all smut, and the other mostly sound. One of the last ears I examined contained forty smut-balls, twenty-one corns that were perfectly sound and good, and five corns that had one end smutty and the other sound.

From

From this state of facts it is hardly possible to resist the conviction that the smut is caused by the inclemency of the atmosphere, and that constantly and invariably in the season of its blowing.

To sum up the whole of this matter then, it seems as certain, as demonstration can render it, that the smut is not owing to any defect or imperfection in the seed, but entirely to some corrupt vitiating principle of the atmosphere, in the blowing season, which blights and destroys the grain in some shape or another, according to the time it has been blowing, when it is struck with the blight. Those ears which are totally deprived of their blowings at the beginning of the season, before the corn in its embryo state is duly impregnated with the *farina fecundans*, or male dust, become abortive, and are absolutely without any corn at all. Those that are further advanced, and have the embryo formed ready for impregnation, if in that state they are deprived of the fecundating principle, either wholly or in part, the milky matter, which constitutes the substance of the grain, for want of the vivifying principle, is wholly, or in a certain proportional part, converted into a ball of black stinking powder, or smut. Sometimes, even after the corn is well formed and filled with the milky juice, sufficiently impregnated with the male principle, it is struck

struck with the blight, which, though it come too late to prevent the perfection of the vivifying principle, and thereby render it unfit for seed, yet it is little more than two rinds, it being in a manner starved, the meally substance of which the flour consists being almost entirely wanting.

From all this it very clearly appears, that all the boasted steepes prepared for preventing the smut are chimerical, and void of all reasonable foundation whatever. In warm dry healthy summers the smut is seldom if ever found, though the land be sown with seed that is smutty, and without any preparation at all. I would however recommend washing the seed in fair water a day or two before sowing. By this means the light imperfect corns, chaff, and seed of weeds, if any, are separated from the seed corn, swim at top, are easily skimmed off, and the remainder rendered much more clean and perfect.

The writer has now several experiments, in prosecution, by which the above observations may probably be satisfactorily confirmed, which he hopes to have the honour of communicating in due time. He does not presume to claim the promised premium, being sensible he has not performed the *literal* conditions, which he apprehends no power is by any means equal to but THAT only which “rides
“ in

“in the whirlwind, and directs the storm.” The Power which is competent to the prevention of the smut in wheat, is equally so to the preservation of the bloom of the fruits of the orchard, the hop garden, from the maggot in peas, the black dolphin in beans, the fly in turnips, and the caterpillar in all the cabbage tribes, whose devastation at this very time has laid the whole country waste. Instead of cabbages nothing is to be seen but the bare ribs of the leaves, like mere skeletons, the hearts, &c. being entirely destroyed.

However great the evil be which attends a crop of very smutty wheat, the sound grain may be made clean, sweet, and wholesome, with little trouble, and a moderate expence, as appears by the following account:

In the year 1787 I had a great deal of very smutty wheat, which would sell for little more than one-half, or at most two-thirds of the price of good wheat, which put me upon making the following experiment:—I took about a gallon of the wheat, and put it into a pail of fair water, and stirred it about well for a minute or two with a stubbed broom. It made the water almost as black as ink. This water was then poured off, and a second added, in which it was again very well stirred, and then
poured

poured off as before. This cleared it entirely from the smut and all discolouring matter. Then, when it was well drained, it was put into a broad shallow pan and set before the fire, when in a short time it became dry enough to grind; for staying so short a time in the water it imbibes very little of it, and what adheres merely to the superficies is soon exhaled by a moderate heat. When dry it was no way distinguishable from the cleanest and soundest wheat, but by the superior brightness of the colour. It had a fairer and more delicate complexion than unwashed wheat, by which it was to be distinguished only, even by those who had long dealt in the article and were in the secret. Encouraged by the success of this experiment, I had a load of it washed, sent it to a malt-house in the neighbourhood, and had it kiln-dried by a very moderate fire. I sent a sample of it to market by a neighbouring farmer, of long experience, without taking any notice to him of what had been done. He said it was a very bright pretty sample, but did not discover it had been smutty or washed, till he had shewn it to a miller of great business, who presently knew what must have caused its brightness; at the same time he owned it was not a penny the worse, as it was now clean and sweet, and perfectly dry. The waste in washing and drying was about two bushels; ten shillings.

shillings I paid the maltster for drying, &c. which made the expence about a guinea, whereby at least three or four were saved. From this account it appears, that a smutty crop is not an evil of such intolerable magnitude as hath been generally thought.

In the conditions of the premium, it seems, are involved, what is impracticable and impossible. In the above account the writer flatters himself, that he has thrown as much light upon the subject as is discoverable by human means, and begs leave to submit it to the candid consideration of the honourable Society, whether such an investigation merits their approbation and *encouragement* or not.

Premiums offered for preventing evils which originate from intemperate seasons and destroying blights, may excite invention, artifice, cunning, imposture, and deception, but can never extend the boundary, or expand the circle of human knowledge, or human power. HE, and HE only, who can repel the malignant blasts of the East, fraught with myriads of consuming insects, which originate from what and where none but Omniscience knows, and substitute the soft, healing, balmy zephyrs of the West, can reward the labours of the industrious husbandman with plenty and happiness!

ARTICLE XVIII.

Of River Weeds as a Manure.

[By Mr. JOHN WAGSTAFFE.]

GENTLEMEN,

IN my communication to you, inserted in your fourth volume, concerning the extraction of river weeds with their roots, but more particularly of the river conferva, as a manure, I proposed to give you a recital of farther experiments then begun, but of which the result was uncertain.

In the course of my address I had spoken with a degree of confidence of the expected success of a barley crop, in succession to the turnips, of which I gave you an account. I have now to add, that my confidence had not betrayed me into a mistaken estimation of this new manure, as on less than one acre and three roods, I had off seventy-seven Winchester bushels of malting barley, besides three bushels of a lighter quality. The quantity of this produce may be ascribed to the general well manuring for turnips with common dung; but on those spaces where none of that extended, a larger produce was apparent; and even on the worst part of a field dibbled with wheat, and where, from its quite opposite quality to a gravelly height on which

the weed-manure was spread, half steril as this space was, were produced ears closer, larger, and with fuller grain, than on a deeper soil extended on a level round it, which had a natural advantage, and a dressing of common manure.

On a part of that space which I have in the former experiment mentioned, where this compost was almost entire, and where savoy and turnip cabbage grew, in the spring of this year I planted ten whole potatoes, at about eighteen inches distance from each other, whose average weight was about four ounces, and equidistant; the parings of about fourteen potatoes in nine divisions; the produce as taken up the beginning of October, was from the ten whole ones twenty-nine pounds four ounces; from the nine divisions of parings twenty-nine pounds twelve ounces. From among these latter (a case of some admiration to me) there arose the largest bulbs; two from these parings weighing thirty-one ounces: the two largest from the whole sets, twenty-five ounces: it may be requisite to remark that the parings were from larger roots than the whole sets. These, from being pared thick, might have their gross weight diminished about one fourth, the other three-fourths answered their usual purposes. It may not be an useless intimation to observe,

observe that such parings, in every soil and situation adapted for the usual feed, will prove an effectual substitute for the whole potatoe, and the farinaceous substance of this most edible root may be applied to all its culinary purposes.

I have extended this river-weed compost, the last season, over a piece of land sown with turnips, which appear with a superiority to others bordering upon them. Another tract of land spread solely with this compost was sown with turnip-rooted cabbage, in the manner begun (I presume) and successfully pursued by Sir Thomas Beevor, as published in your third volume; these are in a prosperous state, and surpassing in size some I had on better land the preceding year, which were well manured, but not with the river compost.

In fine, upon a review of the past and present prosperous appearance of every grain and foddering root, that it hath unfailingly and effectually supported, I cannot help being decided in my opinion, that on all arable lands, such only excepted as are springy, or liable to inundation, it may be more successfully applied than the very common and frequently repeated manure, by which soils are renewed in their strength.

The vast quantities of rank weeds and plants which abound on the banks of the numerous rivers and streams of this country, seasonably cut, and fermented and incorporated with other articles, for manure, according to the judgment and convenience of the farmer, might prove of no small national benefit.

I am, Gentlemen, yours, &c.

Norwich,
Nov. 26, 1788.

J. WAGSTAFFE.

ARTICLE XIX.

On planting Trees on barren Heights.

[By the Same.]

GENTLEMEN,

ABOUT twelve years since a field of elevated land came into my possession; the height of it had been left uncultivated for a course of years, on account of its unproductive quality. The aspect being open to the south, and its soil a deep sand, except its summit, which was gravel; I with pleasure embraced the opportunity of planting it, and had in view different species of American trees,
raised

raised from seeds about three years before, and which had in general exceeded in length of bole, for their age, any of the native trees of Britain that I had known raised from seed. I therefore promised myself, in this heated aspect, an advantage approaching to that of their proper climate. At the same time I planted pines or firs of different distinctions, and of every species of forest trees frequent in our woods; and in which were included the three poplars, considered as the aborigines of our country.

The pines more generally died, (save on the summit) unless I here except the larch, which, if it lived, poorly throve; the Americans lived without increase, perishing in the winter as low in their branches as their unvigorous summer shoots extended. The birch and the sycamore succeeded moderately on this sandy slope, but no other worthy of notice, save the white poplar and the asp, (*populus alba* & *tremula*) the former succeeded with a single exception beyond any instance of its growth I ever saw. A rooted cutting, transplanted here about five feet high, is now in height near or full thirty feet, is in girth eighteen inches five feet from the ground and thirteen feet up its trunk; I believe there are branches nine feet in extent. Yet this progress makes but a part of the obvious

value of this tree; from its roots extending in every direction through the porous soil, new trees are annually rising, whose yearly shoot is frequently more than equal to the stature of the parent tree when first planted, and the two earliest of the offspring, which arose about six years since, are from thirteen to fourteen feet high. I don't know that I am able to number the progeny of this single tree, a little copse having sprung in an area of thirty-five feet diameter: many of the young ones are transplanted elsewhere. The *populus tremula*, which I have introduced with this, has the same facility of throwing out its lateral shoots, but their growth is not equally vigorous with the *alba*, nor is their wood in a state of maturity held to be of equal value. In fine, the motive to this recital is to carry an information of the experienced use that may result from planting suitably lofty ground, of such soil and exposure; whereby it may be compelled by the adaptation of a few proper trees to become an ornamental and beneficial wood, after a few years growth; yet while their growth may supersede the necessity of planting other trees, their close and broad foliage, by excluding the sun, prepares the shaded ground for the reception of other trees, that would otherwise have perished beneath his beams. I have in the last four years replaced
with

with success many feminal plants, where a more general failure of their species was known before.

I can hardly quit the singular and useful progress of the Arbele, without mentioning its prospective appearance when planted on a lofty scite; the silvery nether surface of its leaves, lifted by the gales, exhibits a scenick beauty peculiar to itself.

But scenery was not my object, notwithstanding the frequent intimate union betwixt use and beauty; I meant only to illustrate by facts, that ground circumstanced as the aforementioned may, by a judicious planting of these trees, be covered in a few years with a self-propagating wood. A fall of the early matured timbers leaves room for the augmentation of their natural successors, already coming forward, while their roots are extending to supply the spaces of those which are in succession to be taken away; so that in point of profit also, the object fully recommends itself.

I had an intention of connecting with this the means pursued for correcting and planting a soil and situation, in the greatest extreme different from the foregoing, (boggy and morassy ground), but having misplaced some minutes respecting it, I purpose to take an early opportunity of recovering
 them,

them, and to transmit their purport to you; and am,
with much regard,

Your respectful friend,

Norwich,
Dec. 5, 1788.

JOHN WAGSTAFFE.

P. S. In your last publication is given an invitation to counties remote from your own to send scions from known and valuable fruits within their districts; I therefore wish to inform you, that the longest undecaying apple that I know of, well known here by the name of Beefin,* and which answers every culinary purpose, is frequent in the orchards of our farmers, and has sometimes been planted in hedge-rows, where they retain their pristine quality. Indeed, the prejudice of the country makes this apple to degenerate in any other county; but as this prejudice has no known support, I wish it to be disregarded, and the growth of the tree extended. It may possibly degenerate faster than some others, by its proximity to other species of apples; but this possible inconvenience may be guarded against in the plantation. I therefore hold myself ready, at your time, if requested through your Secretary, to transmit scions of this fruit.

* Named, I have no doubt, from its rind exactly resembling that of the flesh of the beeve.

ARTICLE XX.

Hints for sowing various Kinds of Grain, from certain Phænomena of Nature.

[By the Same.]

GENTLEMEN,

HAVING often been impressed with the idea that a better rule might be obtained for the sowing the various species of grain, than what could be regulated by the calendar, I at length determined to make minutes of my own periods of sowing, as they were in coincidence with the blossoming of well-known trees; or on the return of various birds of passage; together with either the earliest voice or song of either these, or those which are stationary to our climate; with other easily observed adjuncts, which might have a tendency to direct this material business in agriculture. Not confining myself to my own experiments, I made frequent remarks on divers of my neighbours, and endeavoured to ascertain the fullness or thinness of their crops, as they might be at various times sown, in correspondence with the voice or appearance of many of the well-known subjects of nature. These remarks have been continued through several years, by which I conceive I have often discovered when
the

the sowing was too early in one year, which in a subsequent one might be too late, though on the return of the same days of the month; yet from the latter circumstance more crops appeared to be lessened by a protraction *beyond* the beneath-recited periods, than sowing with the earliest coincidence with them; to instance the present appearance for the greatest product of barley, is from the seed sown on the earliest found of the cuckoo, and while the buds of the black-thorn were yet turgid, than what was delayed to the frequent note of the former, and the expansion of bloom in the latter.

It is possible that the following hints may lead some practical farmers to be directed by certain phœnomena of nature, that more generally occur within their observation, as it is well known that there are local subjects in the vegetable and animal kingdoms, that are not diffused through the nation; yet as those I have governed my observations upon are more general, I shall therefore subjoin those whose appearance has been apparently most propitious, when adapted to the sowing of the following grain, pulse, and roots:

Peas and Spring Vetches. As early as the lark arises to sing, and partridges are paired.

Oats.

Oats. When rooks begin to build, and the male blossoms (catkins) of the hazel expand and shed their farina.

Barley. At the earliest discovery of the cuckoo, and the white-swoln buds of the blackthorn.

Cabbage, and Turnip-rooted Cabbage. At the appearance of the hyacinth, (blue-bell) and when the ring-dove (wood-pigeon) begins to coo.

Potatoes. When the wilding or crab apple is in bloom; and perhaps the due period of taking them up is at the dropping of its fruit.

Buck, or Brank. When the hawthorn's bloom is going off with a purple hue, and the young rooks are perceived out of their nests.

Turnips. When the elder flowers, and the early cherry ripens.

Wheat. At the fall of the ashen leaf, or when the grey or Royston crows return; but these being only local visitants, most of the inhabitants in several counties not being acquainted with them, their return is in correspondence with the latest fall of the acorn and the variegated appearance of the

the

the woods. On the appearance of the fieldfare the due period is past.

I think I am not deceived in my observation, that wheat thus timed is not winter-proud, and is least hurt by its possible severity, tillering more freely in the early spring, and consequently becoming more productive.

This theory of sowing has been suggested, and if I remember right recommended by two distinguished naturalists; viz. Doctor Stillingfleet, in his Calendar of Flora, and Doctor Goldsmith, in his History of Animated Nature; nor was it unthought of in earlier periods of English husbandry: I have heard a provincial adage from the mouth of an ancient farmer, viz.

“ When the sloe-bush is as white as a sheet,
 “ ’Tis time to sow your barley, dry or weet.” [wet.]

Indeed the principle, I conceive, is self-evident, “ If the stork knows his time, and the swallow his season of coming;” and as it is a fact that the birds of passage are not always periodical to a day, to a week, perhaps to a month; it will almost be necessarily educed, that their subsistence is not prepared, that nature hath not undergone a change proper for their return, and in course she is not
 ready

ready for a production that their appearance might denote the period for.

I am not insensible that an objection to this indicative sowing may arise, from the observation that the emblossomed tree is often blasted, and the expectation of fruit defeated; that nature herself, not being uniform in her promise of plenty, it evinces she can rear no certain standard to determine the process of art. There is some weight in the objection; but as the casual poverty of an industrious œconomist subverts not the general success of œconomy; and as there is scarcely a general rule without exception, the objection is much weakened.

I am, with respectful regard, &c.

JOHN WAGSTAFFE.

Norwick, Sept. 9, 1789.

It is with some diffidence that we can allow Mr. Wagstaffe's opinions to appear in this questionable shape; but since he delivers them as the result of continued observation, we are willing to give him credit for care in his memorandums.—And the subject is worthy the consideration, at least, of the practical farmer.

ARTICLE

ARTICLE XXI.

Remarks on Smutty Wheat.

[By the Same.]

GENTLEMEN,

IT has been an established opinion with most farmers, that smutty wheat, or that in which the black or smutty balls are frequent, if sown, will assuredly be productive of a foul crop. And it is questionable with many, if any cleansing with water, or steep in any lixivium, will thoroughly purge its foul quality, so that no pollution be conveyed to the future produce.

I therefore beg leave to recite an experiment which hath had a notable effect in obviating, as far as it has been carried, the settled prepossession against sowing any wheat apparently cleansed of this contaminated quality. And what I hold of a superior use, a strain of wheat has been procured, (by what operation of nature I do not profess to have discovered) which hath obtained the reputation of one of the best varieties known in the district in which it is grown.

A neighbour of mine at Baburgh, a speculative and practical farmer, walked into a small piece of
wheat

wheat which I had sown with blended but common strains of wheat, and in his walk he gathered some ears of smutty corn; in the examination of which he detected in four of them eight or nine sound grains; which grains he reserved, and at the common seed-time drenched with brine, which he usually prepared for his seed, and planted them in his garden in the year 1783. These grains produced many ears in 1784, which were generally closer set, and more numerously productive of grain than the frequent strains of wheat. He selected the closer set wheat, and dibbled in their grain, separate from any other; the produce of which was about a quarter of a peck. In 1785 those dibbled in the same manner, that season, produced in the following autumn about half a bushel, which produced by the same mode about nine bushels in 1787, which he principally retained, and had dibbled on several acres; the general produce of which, where he preserved his wheat unblended, was uniformly of the quality of the reserved original ears of 1784. In 1788 he distributed for seed (above his own reserve) to his relations and friends. I had four bushels of this unmixed quality, which preserved its specifick appearance, and attracted the notice of many farmers, one of whom has solicited and obtained from me twenty-four bushels;

bushels; and several bushels beside are in reserve, or already committed to the ground.*

I found it difficult to be less circumstantial, if I would be explicit; and as a reference to what has been experienced, speaks more strongly than mere description, you will excuse a possible redundance; yet I may add, that this peculiarly acquired wheat continues perfect in its quality, and largely productive of quantity. In the last instance none of its several promoters, but are ready and have declared, that their *cast* has been from four to eight bushels per acre more than their ordinary produce on land equally tempered, and under a similar mode of propagation. I cannot yet speak to my own absolute produce, as nearly half remains unthreshed; but I believe it will be more than in proportion to the largest quantity mentioned by my neighbours to have grown on the land before. I may farther add, from different representations I have received, that it is perfectly devoid, through the several trials it has undergone, of the polluted strain from which it originated. I repeatedly walked down the furrows where mine grew, without detecting any approach to smut; nor has any discovery of this

* Its use I conceive is extending; at this time the clerk of the county (P. French, esq;) is setting about five acres of the seed within a parochial district of this city.

pernicious substance been made in what has been prepared for the ground, I therefore cannot but repeat, and conclude, that a variety as profitable, and a strain as pure, has arisen from this experiment as could have resulted from a more elaborate process; and with a certainty that it has hitherto suited all the land on which it has been tried.

I am, your respectful friend,

Norwich,
Oct. 21, 1789.

JOHN WAGSTAFFE.

ARTICLE XXII.

Improved Method of planting Ash for Hurdles, Hoops, Laths, Fencing, and what is termed Post and Billet for Collieries.

[In a Letter to the Secretary.]

SIR,

BEING lately on a visit to a friend in Warwickshire, who lives under Edgehill, I was greatly surprized to see some parts of the declivity covered with fine regular plantations of Ash, whilst the remainder was either overrun with short furze and rushes, or drenched with stagnated water. On

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enquiry

enquiry I found that the improvement had been begun by my friend's father about twenty years before, and has from time to time been extended both by father and son:—That the average price of each acre, when cut at fourteen years' growth, was 70*l.* though the boggy part, before this mode of cultivation, was not worth a farthing. From the stocks or stumps when cut, a larger crop accrues the next fourteen years, and so on perhaps for more than a century. After each cutting it is proper to cover, or rather to earth up, the old stocks with the mould that may have fallen from the sides of the beds into the ditches. The usual price of planting and fencing with quicksets is not more than 8 or 9*l.* per acre. The plantation was thus begun:—As the hill was to be drained, a line in the direction of the hill was drawn from the top to the bottom of the ground intended to be planted; the ash-plants of three years old, having their tops and roots so cut as not to exceed eight or nine inches in length, were laid horizontally on the ground at the distance of three feet and a half, the top part of each plant projecting about half an inch beyond the line: then the labourer, beginning at the lower end of the plantation, that the water may drain off as he goes on, and standing with his back to the hill, with his spade digs the earth from the
line

line on his right to the distance of twenty-one inches, on his left to the depth of twelve or fourteen inches, or what he may think sufficient to carry off the water, and effectually to cover the roots of the plants: he then removes the line in a parallel direction three feet and a half from its former place, lays the plants in the same order as before, and digs out the remaining twenty-one inches to the same depth as before, and throws it on the left hand bed;—thus a ditch of three feet and a half wide is effected:—and as each plant is three feet and a half asunder in the beds, and the ditch is of the same width, each plant has a space exactly three feet and a half square to extend itself in. Then the line is again removed three feet and a half further to the left, when the same process again takes place; care however should be taken that the plants should never be laid immediately opposite to each other, but one opposite the opening between two others, thus, * * * * *

In this mode of cultivation, not only the land is effectually drained, but the plants have also a double portion of vegetable earth, and are thereby enabled to force their horizontal roots rapidly through the bed. Inexperience may perhaps object, that the plants being laid horizontally will not make perpendicular shoots, but nature gives them a perpen-

dicular direction, lay your plants in what manner you please. After planting, no further attention is required, but to cut off any crooked or straggling shoots, and to hoe the plants for the first four years; —the fences also must be well secured. Timber-trees may be planted to advantage in the middle of the beds, in squares of fifty or sixty feet, and if oak, may probably arrive at maturity by the time the stocks begin to fail.

The method of raising quickset hedges also in that part of the kingdom is a very improved one; which is to mark out the ground intended for the fence with a line, on which lay your quickset plants, cut in the same manner as the ash, at the distance of eight inches from each other; then cut a turf close by the edge of the line eight inches thick, lay it when inverted upon the plants, and so on till the whole distance is compleated; then lay another row of plants at the same distance on this turf, one in the opening of that below, which cover with another turf dug on the outside of the other, taking care that they are both laid on an inclined plane from the ditch, which must now be made by throwing up the earth dug under the turfs, to the depth of eighteen inches, to form the bank, and afford nourishment for the roots of the plants. The hedge must then be fenced with hurdles or posts and rails,
otherwise

otherwise the cattle will soon destroy it. In four or five years the hedge will be out of danger, if in the mean time it has been well weeded at least twice a year. The quicksets should not be transplanted into the hedges till they are three or four years old, or about the size of a large goose-quill, and have been regularly cut down to the ground every year since they first made their appearance in the nursery;—this process will increase their shoots more than double. Any of the large roots, which are cut off on transplanting, will form new plants, if immediately put into the ground about three inches distant in the rows, and ten or twelve between the rows, to enable the hoe to pass between them;—the tops should be about half an inch above ground. Thus two years are gained in raising new plants, instead of adopting the old mode from seed.

Should these observations be deemed worthy the attention of the Society, and calculated to promote the object of it, the dissemination of useful knowledge, they are much at their service, from

Sir, your very faithful friend,

And obedient humble servant,

W. B. B.

ARTICLE XXIII.

On the Advantage of Hoeing.

[In a letter to the Secretary.]

SIR,

THE Bath Society frequently bestows premiums on persons who raise the heaviest and cleanest crops of turnips, that have been twice or more times hoed. Might it not be right to extend these premiums to every species of corn and pulse, as none can doubt but those would receive equal benefit from the use of the hoe? The farmer who may be tempted to introduce the hand or horse-hoe through every part of his arable land, would find very little occasion to make use of manure, and might totally extinguish both winter and summer fallows. If he doubt the truth of this assertion, let him try the hoe upon one half, or a less part of his ploughed land, without any manure, for five successive years, and cultivate the other part of his farm agreeably to his usual mode, for the same term of years, and I pledge myself, that double the crop will be obtained from the land whereon the hoe has been effectually used, to that which can possibly be raised upon any lands that are manured and fallowed, or cultivated in the old or common way.

The

The following account, it is presumed, may induce gentlemen and unprejudiced farmers to try the experiment:—

A near relation of mine cultivated a field for upwards of twelve years as follows, and had every year uncommonly large crops. The first year pease were sown in drills, two feet six inches apart, which were twice hand-hoed, and afterwards earthed. They were gathered green, and sent to market, and the straw or haulm was cut and used as fodder for horses. The whole crop was cleared by the 15th of July. The ground was immediately ploughed and sowed with turnips broad-cast, which at the proper season were twice hoed, and were sold for 5l. per acre to a cow-keeper, who cleared them from the land the beginning of February in the second year. Another ploughing then took place, and after the earth was well pulverized it was sown with spring wheat, broad-cast, which was never hoed or weeded, nor did it require it. When this crop was cleared in the autumn of the second year, the ground was ploughed without delay, and spinage was sown in four-foot drills; this stood the winter; and midway between these drills garden beans were planted the following January, or the third year; both crops were hoed. The spinage was part sent to market, and part given to cows, and
was

was cleared by the middle of May. The ground then received another hoeing, and on the same drills where the spinage grew, cabbages (that had been previously raised in a seed plot) were planted. The beans stood for seed, and were sold for 8s. per bushel to a London seedsman. The cabbages were carried from the land, and given to milking cows about the month of February; nor was it thought right to suffer any crops to be fed off this land, fearing the beasts might injure it with their feet, and that the water might stand in the holes their hoofs had made; none but the lightest soils should be trod with cattle. The ploughing commenced for the fourth year immediately after the cabbages were removed; and after the ground was well pulverized, pease were sown in drills three feet asunder; these were gathered and sent to market in the pod, and after the haulm was removed, coleworts (which had previously been raised in a seed plot) were planted about twelve inches distant from each other; these were a good crop, and were sold to the cow-keepers. Thus were eight profitable crops obtained in four years, more than twice sufficient to pay for the fee of the land.—So far says the journal.

I was an eye-witness to the crops which were raised upon the same land the eight succeeding years,

years, and knew them to excel all in that neighbourhood. The mode of cultivation was nearly the same, except that barley was sown one fourth year, instead of the spring wheat; oats were sown once in like manner; and potatoes were once planted between the drills of seed beans; and the hoeing was always attended to and well performed, except when the land was sown with corn. The soil was a light loamy clay of a dusky hue, under which was gravel, at the depth of about thirteen inches. The real value of the land was not more than 20s. per acre; it has been lately laid down with grass, and is come to a good sward, without having any manure laid upon it for more than sixteen years, twelve of which it was cultivated as before related.

Surely this proof may encourage farmers to try the hoe upon a large scale and on different soils.

I am, the Society's most obedient servant,

JOSIAH HAZARD.

Holt, Dec: 18, 1788.



ARTICLE

ARTICLE XXIV.

*An Account of the Guinea and Scotch Grasses,
and the Manner of cultivating them in the
West-Indies.*

[By J. SPOONER, esq; to the Secretary.]

SIR,

THE Guinea and Scotch grasses, produced in the West-Indies, and of which you desired an account, are of such great utility, that the preservation of the stock there frequently depends upon them.

The *Guinea grass* appears capable of thriving in any situation, in respect to climate and soil, and can bear the effects of dry or wet weather in a most remarkable manner.

In wet weather it grows so fast, that it may be cut once in a fortnight, and sometimes oftener, when the land which yields it is new or fertile.—In dry, it is a long time before it withers, and, when reduced thereby to such a state as to seem totally destroyed, will revive with a slight shower in a very few hours; and when rain falls, though in so sparing a degree as to be of little or no service to
common

common pastures, it will occasion this to vegetate, and to be fit for use in a few weeks: nay, in some situations, not too much exposed to the heat of the sun, it is known to flourish, and derive ample support, from occasional dews only. It has, farther, so peculiar a quality of stocking, that, with very little care in its infancy, it will overcome all other grass and weeds; and in ground full of stones and rocks, though planted at very great distances, at random, as the appearance of soil admits, will spread itself about them, in a few months, and at last cover them entirely. This grass, when ready to feed, is from six to eight feet high; but it is generally fed upon, or cut, when only three or four.

It agrees with all kinds of stock; and horses, mules, and cattle, when turned out to feed upon it, will fatten so fast, that the two former will be in good condition in a couple of months, or less; and the latter will become fit for the butcher in the course of three months.

The cultivation of this grass is very easy, and attended but with little care, expence, or trouble. It is not immediately produced from the seed, but is previously planted. The land intended for it is generally made perfectly bare by hoeing, and holes are then dug thereon, from three to five feet distant,

tant, varying in this respect according to the quality of the soil; that is, if it be rich, the holes are to be made at a greater, and if poor, at a less distance. These holes should be large, and deep enough to admit, and bury a good depth, a few roots of the grass. The roots to be planted are dug up from a neighbouring field, or nursery; and the grass arising from them being topped, within three or four inches, they are put into each hole, and well covered with earth, pressed down by the foot. Care is taken to keep the plants free from weeds by repeated hoeings. The months most approved of for planting, are April and May, as the grass will then seed in September and October, at which periods it is found to seed by far the most abundantly. It is necessary to be careful that the ground is quite clean when the seed is ready to drop; and if the spaces between the roots are then stirred up with the hoe, it will be found very beneficial.

When the seed is all fallen, stock is turned in to tread it into the ground, and feed upon the grass. In very rich and new land, the grass at first will grow so rank as to produce very thick stalks, which, by running up the noses of the stock, will prevent them from eating it so close as they otherwise would. When, however, it is eaten as
near

near the ground as possible, the remaining grass, with the roots which were planted, are dug up with the hoe and burnt off. The grass after this, if favourable rains attend, will grow from the seed, and by covering the ground in the month of May following, will be perfectly established for several years, according to the quality of the land, so as to be cut for use, or become a pasture.

Whenever the grass grows thin, holes may be opened in such places as may occasionally appear so, and roots again planted to supply it; and, by this attention bestowed upon it, a field will scarcely ever be so totally worn out as to require the labour of being at any one time replanted.

The blades of this grass, when flourishing, appear not unlike those of wheat, only rather broader and longer; and the stalks, during the first growth, are also much like those of it, but they get weaker and less, the oftener the grass is fed upon or cut, till at last it becomes a fine, rich, and entire sward.

The mode of cultivation already mentioned is the one generally approved of, but Guinea grass may also be brought to perfection by other means. The stalks being buried a few inches deep, each joint thereof will take root, and grow luxuriantly;
or

or it may be produced directly from sowing the seed, the ground being previously prepared for that purpose. This last mode is not preferred, on account of the seed lying many months in the ground before it makes its appearance. Some planters do not stock up the roots which are planted, as before related, when the grass has seeded; and some depend upon what they afford, by continually feeding upon, or cutting the grass when at a certain height, without ever allowing it to seed. But, in comparison with the first, all these modes of management are to be esteemed as inferior.

The *Scotch grass* is chiefly produced in low, marshy lands, that have a running stream or river through them, and can be easily overflowed when dry weather would affect it. It is generally cut for use, and given to the stock; and in good seasons, that is, if light showers now and then assist, will admit of cutting once a week or oftener.

The blades of this grass are longer, broader, thicker, and of a darker green, than the Guinea grass; and the stalks much larger, and more juicy and pithy. It is an excellent food for horses, mules, and cattle; but is not made use of, and perhaps is not so well calculated for sheep, or to
fatten

fatten cattle, as the Guinea grafs. In general it is merely appropriated to the stable; and the quantity which the ground yields, and the quickness of its growth, render it very useful and valuable, particularly near towns in the West-Indies, which afford a market for it.

This grafs is also cultivated by being planted, which is thus accomplished:—The land is freed from all weeds, sedges, and rubbish, by their being clean hoed, and burnt off, and requires to be laid out so as to admit of being overflowed; and also to be so well drained, that no water can lodge to stagnate, and destroy the grafs. The grafs to be planted is cut into junks, every joint thereof, which is from five to ten inches long, being a junk, or plant. A single one is stuck in the ground with the joint downwards, and in this manner they are distributed at random, so as to be about six or eight inches apart. In a few hours these joints begin to shoot, and take root; and in the course of three weeks, or a month, the grafs will grow sufficiently high to be cut, which is when it is about six feet. As the grafs grows, weeds and all extra productions are freed from it, by being pulled up as they appear, and put into heaps to be dried and burnt off. Care is taken when it is cut, also to weed at the same time; with which management,
and

and attention that the drains be kept open, that it may be overflowed when dry weather hurts it, and supplied in all places as they appear thin, by sticking junks in, as before described, the land is perpetually established with the grass, and yields it in a most extraordinary abundance.

ARTICLE XXV.

Experiments on Drilling.

[By Sir JOHN ANSTRUTHER, to the Secretary.]

SIR,

I Send you some small experiments I made on my crop of 1787. The produce of part of it being late in the season before it was threshed, it was late in the year before I received the account of it.

I am sorry to observe an error in the publication of the last experiment I sent to the Society, of crop 1786.

Page 262, line 3. "With partitions of fourteen inches, *two intervals three feet four inches.*"

I cannot imagine how I could have overlooked such a blunder in the copy.

There

There could not be two intervals, and had the ridges been of equal breadth, the interval would have been nearly four feet eight inches. But as the blunder is so plain, every one must observe it to be so. I am, Sir,

Your most humble servant,

London, J. ANSTRUTHER.

Wimpole-street, March 17, 1789.

The following Experiments were made in 1787.

One acre, statute measure, was drilled with white wheat, after the plough, sowing by hand the first furrow, and another plough following and covering the seed; and the seedsman sowed the third furrow as the first, so that the rows were at 18 inches. This field was drilled beans the former crop, and drilled in the same manner.

The wheat was drilled upon one ploughing; upon this was sown 1 bushel and 4-5ths of a gallon. The produce was 27 bushels and 3 pecks.

The ears upon four yards were counted. One yard produced 82 ears, one 87, one 98, and one 88. The average is 88 ears per yard.

Three acres and three roods were sown next to it *broadcast* with the same wheat.

B. P. G.	B. P. G.
Upon this was sown 10 3 1	which is per acre 3 0 1 $\frac{1}{2}$
The produce was 30 2 0 $\frac{2}{3}$	per acre.

AGAIN:

The same measure of one acre was drilled with red wheat, in the same manner after the plough.

B. P.
The seed sown upon it was 1 1 per acre.
The produce was - 27 0 ditto.

Four acres next to it were sown *broadcast* with the same wheat.

B. P. G.
The seed sown was 2 2 0 $\frac{1}{2}$ per acre.
The produce was 24 2 0 ditto.

RECAPITULATION.

White Wheat <i>drilled</i>	B. P. G.	<i>Broadcast.</i>	B. P. G.
Produce -	27 3 0	Deduct feed	30 2 0 $\frac{4}{5}$
Deduct feed	1 0 0 $\frac{4}{5}$		3 0 1 $\frac{2}{5}$
	26 2 1 $\frac{1}{5}$		27 1 1 $\frac{1}{5}$

COMPARISON.

Broad	-	27	1	1 $\frac{1}{5}$	}	0 0	8 $\frac{7}{10}$	}	after one.
Drilled	-	26	2	1 $\frac{3}{5}$	}	0 0	26 $\frac{5}{10}$	}	
		0 2 1 $\frac{2}{5}$					Broadcast superior.		

These

These crops were twice horse-hoed between the rows with a plough.

Red Wheat drilled.				<i>Broadcast.</i>				
		B.	P.	G.		B.	P.	G.
Produce	-	27	0	0		24	2	0
Seed	- -	1	1	0	Seed	2	2	0 $\frac{3}{4}$
<hr/>				<hr/>				
		25	3	0		21	3	1 $\frac{1}{4}$

COMPARISON.

Drilled	-	25	3	0	}	-	20 $\frac{6}{10}$	} after one.
Broadcast		21	3	1 $\frac{1}{4}$	}	-	8 $\frac{7}{10}$	
		<hr/>					3 3 0 $\frac{3}{4}$ Drilled superior.	

The next field to this was only separated by a hedge, and of equal quality. It was in wheat drilled, and planted the last year. As the former ridges of the drilled were of unequal breadth, and that on which the transplanted grew was very hard, it was all cross-ploughed, harrowed, and ridged anew. The half acre for horse-hoeing was ridged into twenty ridges four feet eight inches, and two half ridges, in place of seventeen last year. This the ploughman did very accurately.

The other half acre was made in ridges twelve feet broad, which made each the sixteenth of an acre. Upon this half acre was drilled (the 28th

of October) two pecks and a half of red wheat; it was five times horse-hoed, and twice hand-hoed in the partitions. The produce was ten bushels and two pecks, which is at the rate of twenty-one bushels per acre. From which deduct the feed, 2 pecks 1 gallon, there will remain 20 bushels, 1 peck, and 1 gallon, which is $16\frac{3}{5}$ after one.

The half acre horse-hoed was hoed with a Rotherham plough.

In the rows of this were several empty spaces of above one foot, and it was much hurt by the birds, having a hedge on one side, and a hedge at one end of the ridges. And as the ridges were drilled where the furrows were last year, by this there was only a single row on each side of the field upon the half ridges. This single row produced but few ears, as it was horse-hoed only on one side, and most of these ears were destroyed by birds.

The ears in a yard of four double rows were counted at different places of the field, two at the top, and two at the bottom of the field; in all, eight single rows.

1 yard

Ears.		Ears.	
1 yard produced	103	5 yards produced	130
2 - - - -	115	6 - - - -	119
3 - - - -	113	7 - - - -	128
4 - - - -	85	8 - - - -	116

Average 113 ears.

These ears were much larger than the ears of the equally distant rows.

To see the proportion of the produce between these and the equally distant rows. As the latter are at 18 inches, and the breadth of an acre is 22 yards, this makes 44 rows in breadth, which, exclusive of head ridges, (suppose 6 yards for the two) makes 94:6 yards drilled.

In the drilled and horse-hoed with two rows upon 4 feet 8 inch ridges. As there are fourteen in the breadth of an acre, or 28 rows, and 220 yards in length of an acre, exclusive of head ridges, of 6 yards for the two, making 168, there remain to be drilled 5992 yards; which are 3424 yards of rows less than the equally distant, or above one-third, or as 3 6-10ths to 6 4-10ths.

The equally distant rows produced 25 bushels and 3 pecks. And the horse-hoed produced 20

U 3 bushels,

bushels, 1 peck, and 1 gallon, which is 5 bushels, 1 peck, and 1 gallon, less than the equally distant, or nearly one-fifth less: but the proportion of yards was one-third. If the produce of the horse-hoed had been the same as the equally distant rows, in proportion to the measure, it should have been 16 bushels 1 peck; but as it produced 20 bushels, 1 peck, and 1 gallon, this is 4 bushels and 1 gallon more than the same length of the equally distant rows, or one-fourth more, notwithstanding the two single rows were almost totally destroyed.

And the 25 bushels 3 pecks, the equally distant rows produced, at 60 pounds per bushel, multiplied by ounces and divided by the yards of the rows, will be 2 ounces 7-10ths per yard of single rows.

By the same calculation, the horse-hoed producing 20 bushels, 1 peck, and 1 gallon, will be 3 ounces 3-10ths per yard, or 6 ounces 6-10ths per double row.

By counting the ears per yard, it is also shewn there were more ears per yard. As the equally distant rows produced only 88 ears per yard, but 113 in the Tullian, the average ounces of the horse-hoed is 3 3-10ths.

But

But from the number of ears counted per yard, being 113, if we allow 40 grains per ear, and 800 per ounce, (allowing them small) the yard of single rows would produce 5 ounces 6-10ths, or at the rate of 35 bushels per acre, were the field all equally good.

Nov. 1st. Two ridges, or 1-8th of an acre, was planted with wheat from seed sown in the garden the 15th of July; each plant was at nine inches distance every way. The produce was 3 bushels, 2 pecks, and 1 gallon, which is at the rate of 29 bushels per acre.

Nov. 2d. One ridge the same breadth, the 16th of an acre, was dibbled with wheat at nine inches distance every way, and the grains dropped by hand, in different quantities, from 3 grains per hole to 15. The produce was 1 bushel, 2 pecks, and half a gallon, or at the rate of 26 bushels per acre.

Nov. 3d. One ridge, the 16th of an acre, was drilled by hand; the furrows were made by hand with an hoe, at 12 inches distance, and the seed was covered with a rake. The seed sown was the fourth of a peck, or half a gallon, and at the rate of 1 bushel per acre. The produce was 1 bushel, 3 pecks, and at the rate of 28 bushels per acre, or 28 after one,

March

March 12th. One ridge, the 16th of an acre, was planted with plants from the garden, the same as were transplanted on the other two ridges on the 1st of November, and also at nine inches distance every way. The produce was one bushel, 2 pecks, or at the rate of 24 bushels per acre.

All the others were reaped the 8th and 9th of September, 1787; but those transplanted on the 12th of March were not fit to cut until the 2d of October.

All these were frequently hand-hoed and cleaned in the rows.

ABSTRACT.

	<i>Produce.</i>	<i>Part of</i>	<i>Bushels</i>
	<i>B.P.G.</i>	<i>an acre.</i>	<i>per acre.</i>
Two ridges, 8th of an acre, transplanted Nov. 1st, - - - - -	3 2 1	1-8th	29
One ditto, dibbled with grain Nov. 2d,	1 2 1	1-16th	26
One ditto, drilled by hand (seed $\frac{1}{2}$ gallon)	1 3 0	1-16th	28
One ditto, transplanted March 12th,	1 2 0	1-16th	24

These small experiments might have produced more, if they had been executed by those accustomed to that culture, and more accurately hoed; but as they were executed by common ploughmen, not accustomed to drilling, or accuracy in hoeing, (as was the case last year in forming the ridges, by making

making seventeen instead of twenty-one) it cannot be expected to be well executed. But these experiments, done by those men, shew the system in a fairer view, and prove what may be done by any farmer to more advantage, by his attending to the execution.

I have made experiments of drilling for a great many years, and have never found any difficulty in getting it executed with tolerable accuracy by common ploughmen, either in marking out the ridges at first straight, and of the proper breadth, or in drilling or horse-hoeing.

ARTICLE XXVI.

*On the Watering and Management of Flax,
addressed to Sir John Miller, Bart. a Vice-
President of this Society.*

[By JOHN GRAY, Esq.]

DEAR SIR,

THE inclosed is the paper I mentioned to you last year, and which, from my neglect, was afterwards omitted to be communicated to you.

The

The reflections contained in it occurred to me several years ago, from observing, when I was last in Scotland, what appeared to me great mismanagement in the watering of flax. Mr. Curtis, two years ago, asked my leave to publish them in his *Flora Londinensis*, article Flax; but as that elegant and expensive work is not in every person's hands, I last year got them inserted in the Gentleman's Magazine for June, and in the Public Advertiser; in consequence of which, experiments were made in Ireland and in Scotland, with success, according to the reports. However, if the improvement proposed be a really essential one, which a variety of experiments can alone evince, the reflections will bear being *decies repetitæ*, and on that account I propose publishing them again this year, and have sent you this copy to be communicated, if you think proper, to the Bath Agricultural Society.

I have the honour to be,

Dear Sir,

Your most obedient,

and most humble servant,

JOHN GRAY.

To Sir John Miller, bart.

Extract

*Extract from one of the Dublin News-Papers,
for August 1787.*

“ It is conjectured, and with a great degree of plausibility, that flax might be instantaneously prepared for the purpose of skutching, and all the time and labour of the present process saved by immersing it in boiling, instead of cold water. So far as speculation may be allowed, and an analogy with the effects of cold and boiling water will hold good, there is every reason to think the experiment would be crowned with success. On a smaller scale we have the authority of a gentleman to assert, that the above mode has been practised with success. One of his undertenants had occasion to bring some yarn to market, but had no flax prepared; and but one day intervened with the market: she pulled some green flax, and merely for experiment boiled it in a large iron pot for some time, when it so fully answered her expectation, that she was enabled to put the flax through all its operations, and bring it to market next day in yarn.
S'en est trop, j'en doute.

“ I have not yet received the particulars of the experiment in Scotland; but Sir John Sinclair, to whom I sent a copy of my reflections, tells me that a clergyman of Caithness of his acquaintance tried the

the new method successfully, and gave him some flax prepared by that method, which he put into the hands of Mr. Arbuthnot, secretary to the trustees for fisheries and manufactures at Edinburgh.”

Reflections relative to the Watering of Flax by a new Method, so as to shorten labour, probably too add to the strength of the Flax, and give it a much finer colour, which would render the operation of bleaching safer and less tedious.

Though the following reflections have for their object an improvement in the very essential article of watering of flax, yet I must advertise my reader, that they are only theory, and must depend entirely for their truth and justification upon future experiments to be skilfully and judiciously made. Should repeated trials prove the advantage of the new method proposed, we may venture to affirm, that it would be an improvement that would increase the national income in the agricultural branch many thousand pounds annually; would add greatly to the perfection of the linen manufacture; and over and above, would suppress a very disagreeable nuisance, which the present method of watering flax occasions during some part of the summer in every flax-growing country.

The

The intention of watering flax is, in my opinion, to make the boon more brittle or friable, and by soaking to dissolve that gluey kind of sap that makes the bark of plants and trees adhere in a small degree to the woody part. The bark of flax is called the *harle*; and when separated from the useless woody part the *boon*, this *harle* itself is called flax. To effect this separation easily, the practice has long prevailed of soaking the flax in water, to a certain degree of fermentation, and afterwards drying it. For this soaking some prefer rivulets that have a small current, and others stagnant water in ponds and lakes. In both methods the water acts as in all other cases of infusion and maceration; after two or three weeks it extracts a great many juices of a very strong quality, which in ponds give the water an inky tinge, and offensive smell; and in rivulets mix in the stream, and kill the fish. Nay, if this maceration be too long continued, the extracted and fermented sap will compleatly kill the flax itself. For if, instead of two or three weeks, the new flax were to lie soaking in the water four or five months, I presume it would be good for nothing but to be thrown upon the dunghill; both *harle* and *boon* would in that time be compleatly rotted; yet the *harle* or flax, when entirely freed from this sap, and manufactured into linen, or into ropes, might lay many months under water without
being

being much damaged; as linen, it may be washed and steeped in scalding water twenty times without losing much of its strength; and as paper, it acquires a kind of incorruptibility.

It appears then essential to the right management of new flax, to get rid of this pernicious vegetative sap, and to macerate the boon; but from the complaints made against both the methods of watering now in use, there is reason to think that there is still great room for improvement in that article. In rivulets, the vegetative sap, as it is dissolved, is carried off by the current, to the destruction of the fish. This prevents the flax from being stained; but the operation is tedious, and I have been told, often not compleat, from the uncertainty of knowing when it is just enough, and not too much, or perhaps from neglect. In ponds, the inky tinge of the water often serves as a kind of dye to the flax, which imbibes it so strongly, that double the labour in bleaching will hardly bring the linen made of such flax to an equality in whiteness with linen made of flax untinged. This seems to be equally unwise, as though we were to dye cotton black first, in order to whiten it afterwards. These ponds besides become a great nuisance to the neighbourhood; the impregnated water is often of such a pernicious quality, that cattle, however thirsty, will not drink
of

of it; and the effluvia of it may perhaps be nearly as infectious as it is offensive. If this effluvia be really attended with any contagious effects in our cold climates, a thing worth the enquiring into, how much more pernicious must its effects have been in the hot climate of Egypt, a country early noted for its great cultivation of flax.

I have often thought that the process of watering might be greatly improved and shortened by plunging the new flax, after it is rippled, into scalding water, which, in regard to extracting the vegetative sap, would do in five minutes more than cold water would do in a fortnight; or perhaps more than cold water could do at all, in respect to the clearing the plant of that sap. Rough almonds, when thrown into scalding water, are blanched in an instant; but perhaps a fortnight's macerating those almonds in cold water would not make them part so easily with their skins, which are the same to them, as the harle is to the flax. Were tea-leaves to be infused in cold water a fortnight, perhaps the tea produced by that infusion would not be so good to the taste, nor so strongly tinged to the eye, as what is effected by scalding water in five minutes. By the same analogy, I think flax, or any small twig, would be made to part with its bark much easier and quicker by being dipped in
boiling

boiling water, than by being steeped in cold water. — This reflection opens a door for a great variety of new experiments in regard to flax. I would therefore recommend to gentlemen cultivators and farmers, to make repeated trials upon this new system, which would soon ascertain, whether it ought to be adopted in practice or rejected. One thing, I think, we may be certain of, that if the Egyptians watered their flax in our common manner, they undoubtedly watered it in *very warm water*, from the great heat of their climate, which would probably make them neglect to think of water heated by any other means than that of the sun. A good general practice can only be established upon repeated trials. Though one experiment may fail, another with a little variation may succeed; and the importance of the object desired to be obtained will justify a good degree of perseverance in the prosecution of the means. In this view, as the Chinese thread is said to be very strong, it would be worth while to be acquainted with the practice of that distant nation, in regard to the rearing and manufacturing of flax, as well as with the methods used by the Flemings and the Dutch.

Boiling water, perhaps, might at once clear the new flax from many impurities, which, when not removed till it be spun into yarn, are then removed
with

with difficulty, and with loss of substance to the yarn. Why should not the longitudinal fibres of the flax, before they are spun into yarn, be made not only as fine, but as clean as possible? Upon the new system proposed, the act of bleaching would begin immediately after the rippling of the flax; and a little done then might, perhaps, save much of what is generally done after the spinning and weaving. To spin dirty flax with a view of cleaning it afterwards, appears to be the same impropriety as though we were to reserve part of the dressing given to leather till after it is made into a glove.

Should the plunging the flax into the boiling water not suffice to make the boon brittle enough, as I am inclined to think it would not, then the common watering might be added; but in that case, probably, half the time usually given to this watering would suffice, and the flax might then be laid in clear rivulets without any apprehension of its infecting the water and poisoning the fish, or of being discoloured itself; for the boiling water into which it had been previously put, would have extracted all the poisonous vegetative sap, which I presume is what chiefly discolours the flax, and kills the fish.

On the supposition that the use of boiling water in the preparation of flax may be found to be advantageous and profitable, I can recollect at present but one objection against its being generally adopted. Every flax-grower, it may be said, could not be expected to have conveniences for boiling water sufficient for the purpose; the consumption of water would be great; and some additional expence would be incurred. In answer to this I shall only observe, that I presume any additional expence would be more than reimbursed by the better marketable price of the flax; for otherwise any new improvement, if it will not quit cost, must be dropped, were it even the searching after gold. In a large cauldron a great deal of flax might be dipped in the same water, and the consumption perhaps would not be more than a quart to each sheaf; even a large household pot would be capable of containing one sheaf after another; and I believe the whole objection would be obviated, were the practice to prevail with us as in Flanders and Holland, that the flax-grower and the flax-dresser should be two distinct professions.

I shall conclude with recommending to those who are inclined to make experiments, not to be discouraged by the failure of one or two trials. Perhaps the flax, instead of being just plunged into
the

the scalding water, ought to be kept in it five minutes, perhaps a quarter of an hour, perhaps a whole hour. Should five minutes, or a quarter of an hour, or an hour, not be sufficient to make the boon and harle easily separate, it might perhaps be found expedient to boil the flax for more than an hour, and such boiling when in this state might in return save several hours boiling in the article of bleaching. It is not, I think, at all probable, that the boiling of the flax with the boon in it would prejudice the harle; for in the course of its future existence it is made to be exposed twenty or forty times to this boiling trial; and if not detrimental in the one case, it is to be presumed it would not be detrimental in the other. Perhaps after the boiling, it would be proper to pile up the flax in one heap for a whole day, or half a day, to occasion some fermentation, or perhaps immediately after the boiling it might be proper to wash it with cold water. The great object when the flax is pulled, is to get the harle from the boon with as little loss and damage as possible; and if this be accomplished in a more compleat manner than usual, considerable labour and expence will be saved in the future manufacturing of the flax. On this account, I think, much more would be gained than lost, were the two or three last inches of the roots of the stems to

be chopped or clipped off previous to the flax being either watered or boiled. When the flax is watered, care should be taken not to spread it out to dry, when there is a hazard of its being exposed in its wet state to frost.

ARTICLE XXVII.

On Mangel-Wurzel.

[By the Rev. Mr. BROMWICH, to the Secretary.]

SIR,

DESIROUS to try the success of the Mangel Wurzel in our climate, and whether, with us, it might merit those high encomiums it has met with abroad, I was induced to make the following experiment to ascertain its value. If you think the observations I have been hitherto able to make will be of the least utility in promoting the cultivation of so beneficial a plant, I shall be happy in having communicated them to you.

I am, Sir,

Your most obedient humble servant,

BRYAN J'ANSON BROMWICH.

Cliff-House, near Bridgnorth, Dec. 1, 1788.

Observations

Observations on the Cultivation of the Mangel Wurzel.

In the beginning of last April I prepared about a quarter of an acre of light ground, by forking it over, it having been left exceedingly foul and impoverished by a former tenant. I mention this, as it will; together with the dry season; in some measure account for the smallness of the roots; the largest not having exceeded six pounds in weight.

As soon as the land was cleaned, as well as so early a season would admit of, I divided it into two equal parts; one half to be set with young plants from a seed bed, and the other part with seeds at half a yard distance from each other, in order to ascertain the best of these two methods of planting. The last I find is much to be preferred, as the plants that were never transplanted, though late sown, soon outgrew the others that were.

March 10th, the first seeds were sown in the seed-bed, and transplanted into the field the 10th of May following; the roots having attained the thickness of a goose quill.

April 15th, one half of the ground in the field was sown with seeds, being dropped at half a yard distance from each other, the same in which they were to remain, and put about an inch deep into

the soil. Every seed commonly produces more than one plant, sometimes three or four, so that it is necessary to draw up the smallest, about ten days after they appear above the ground, when sown in this manner.

May 26th, the first crop of leaves was gathered, being then at their full growth, and more than a foot long, many measuring eighteen inches. A fresh crop of leaves was constantly collected afterwards, every ten days or a fortnight, during the summer and autumn, until frosts somewhat retarded their vegetation. The last crop of leaves is not yet gathered.

The land, being very full of weeds and couch grass, was obliged to be hoed three times during the summer, notwithstanding the amazing luxuriancy of the plants, which covered all the ground; this foulness of the ground, together with the dryness of the first part of the season, prevented the roots from gaining their usual magnitude; none of mine having exceeded six pounds in weight.

The first attempt, in disposing of the leaves, was to offer them to some milch cows, which fed upon them with great avidity, and even preferred them to clover, or any thing else that could be
given

given them. Young calves were also very fond of the leaves, and would hardly touch any other food after they had eaten of them, except milk. Pigs, I believe, prefer them to any other vegetable that they are commonly fed with, and feed faster with them than with potatoes. I do not find that horses are fond either of the leaf or root; after repeated trials they will sometimes eat a few leaves, but soon leave them for other food.

I have chiefly appropriated my crop of leaves to the feeding of pigs; and perhaps the following account of the actual profits I have made, will place the utility of this plant in a more obvious point of view, than by any other mode in which I could possibly express myself.

Two cows were fed four weeks entirely with mangel-wurzel leaves, and two calves eight weeks.

Sept. 18th, Sold four pigs at 1l. each, fed entirely with the leaves from the time they were eight weeks old.

Nov. 16th, Sold four pigs for 5l. 5s. fed with the leaves from the time they were weaned.

Besides the above, upwards of twenty pigs, of all sizes, have been constantly fed with these leaves,
since

since the 26th of May till the present time. Moreover, in a quarter of an acre of ground, there are about 2400 plants; the average, therefore, at 4lb. per root, makes 9600 pounds weight of root for winter provision.

CALCULATION.

<i>Debtor.</i>	<i>£.</i>	<i>s.</i>	<i>d.</i>
To forking the land - - -	0	14	0
To hoeing - - - - -	0	4	0
To gathering the leaves - - -	1	0	0
To cost of 8 pigs, at 8s. each - - -	3	4	0
	<hr/>		
	<i>£.</i> 5	2	0

<i>Creditor.</i>	<i>£.</i>	<i>s.</i>	<i>d.</i>
By keep of 2 cows four weeks, at 1s. each	0	8	0
By ditto, 2 calves 8 weeks, at 6d. each -	0	8	0
By sale of 4 pigs - - - - -	4	0	0
By ditto of ditto - - - - -	5	5	0
By 20 pigs, kept 28 weeks, at 4d. each	9	6	8
By 9600lb. of roots for store, at 6d. per } 100lb. - - - - - }	2	8	0
	<hr/>		
	21	15	8
	5	2	0
	<hr/>		
Profit	<i>£.</i> 16	13	8

I hope the rates of feeding the different kinds of stock will at least be deemed sufficiently low: they are much too low for these parts.

However

However considerable the profit from the above calculation may appear, I am very certain the produce of the roots will be far above what I have expressed: I am convinced that the root will fatten any animal, that will eat it, much quicker than the root of the potatoe; but which I have estimated far below the value of that root by weight. If therefore the produce of the crop, so poor as mine, where the average would hardly admit of four pounds per root; the advantage of a good one, where they run from ten to twenty pounds weight, must be far superior to any other vegetable I have the least idea of.

I am happy to find that this plant, as the benevolent Doctor Lettsom suggests, may prove particularly useful to poor people; for, besides the advantage arising from it, for culinary purposes, a very small bit of land will enable them to keep a cow, or at least a pig all the summer, which now few can do without being at more expence than the animal profits them.



ARTICLE XXVIII.

Further Experiments on Mangel-Wurzel.

[By the Same.]

Cliff-House, near Bridgnorth,

SIR,

May 25, 1789.

AS, from my former remarks on the culture and produce of the Mangel Wurzel, you wished to be informed of my success in regard to the roots; I have to mention, that they remained in the ground so late as the 16th of December, when one part was taken up, and after having the leaves cut off, the roots were piled up in a building, and covered with straw, to preserve them from the frost. A part was left in the ground, in order to see if they would endure the severity of our winters equally with the turnip; but as the frost was so very intense, subsequent to the 16th, it was impossible to ascertain that point, as both equally perished.

The greater part of the roots, when cut in pieces, was given to milch cows; and the butter at that time was esteemed equal to the best, when produced from grass. From this trifling experiment I could easily perceive two advantages this root has over the turnip; it feeds cattle much quicker, and communicates

communicates no offensive taste to the milk. The remainder of the roots were given to pigs; two were entirely fatted by them, and weighed about 260lb. each when killed.

I have this year sowed more, and should any thing occur in regard to the culture and management worth mentioning, I shall be happy to communicate it.

I am, Sir, your obedient servant,

BRYAN JANSON BROMWICH.

[The severity of the frost in the winter of 1788 was uncommonly great, and therefore it cannot be surprizing that the roots of this luxuriant vegetable should perish in common with the turnip; but from other accounts which we have received, we may conceive a hope that the Mangel Wurzel, in a dry and healthy soil, is capable of resisting the influence of common degrees of frost, and that though the accounts of its excellence, as food for cattle in general, are not numerous, it will yet be found valuable for that purpose in many situations. We esteem ourselves much obliged to Mr. Bromwich for his account of experiments conducted with so much care and precision: and if the plant in question shall be found but half as profitable in general for feeding pigs, as it appears to have been to him, it will ultimately rank among crops of consequence to the farmer.]

ARTICLE XXIX.

An Account of an Experiment made in the Year 1788, in raising of the Mangel-Wurzel.

[By JAMES BERNARD, esq; of Crowcombe.]

IN the beginning of the year 1788, Dr. Lettsom, through the intervention of a friend, gave me 67 seeds of the Mangel-Wurzel, which I sowed in the hot-bed the latter end of March 1788, and they all came up in about eight or nine days. On the 14th of May sixty-six of the plants were transplanted into a common bed in my kitchen garden; the bed was 23 feet long and 5 feet wide, the plants were placed about 17 inches apart every way from each other, the outer plants being placed near the edge of the bed. On the 13th or 14th of June, in the midst of that remarkably dry and hot weather, they were all well hoed and cleared of all weeds; the plants grew vigorously, and upon the first rain shot out their leaves so strong as entirely to cover the ground, and prevented any weeds from growing afterwards.

In the beginning of August I took up one of the plants of about 3½ lb. weight, by way of taste and trial, and had the leaves and root boiled. The taste of the leaves was so much like spinach I could

could scarcely have known it from that vegetable; the root had a sweet and rather earthy taste, somewhat like the beet, but not so earthy; it was more like a turnip boiled with sugar, and was far from being a pleasant food to my palate, though certainly very eatable. From its sweetness I should suppose a saccharine juice might be produced, from whence by distillation a spirit might be extracted, and possibly superior to what has been drawn from potatoes.

The plants were afterwards suffered to remain till the 18th of November 1788, when the remaining sixty-five plants were taken up, in order to be carefully put aside to be replanted again next spring for seed. I had them weighed, the leaves by themselves and the roots by themselves, and the weight of the whole crop was as follows:

	Pounds.
The leaves and tops of the 65 plants weighed	202
The roots weighed	340½
Total weight	542½
The corner plant, which had more space to extend its roots and branches in, was so large that I was induced to weigh it by itself, and I found the	
leaves weighed	6½
The root	15½
Total	22
	This

This circumstance convinces me that I planted them too near each other, otherwise my crop would have been much larger; but as it is, surely it is no inconsiderable produce from so small a piece of ground.

Whether this plant will be a pleasant and nutritive food for cattle I cannot at present say, having yet made no fair trial of it. I gave some of the leaves of it to my cows, but they declined eating it; it was hardly a fair trial, as the cows were just brought home to be milked, out of a very fine rich meadow, where there was plenty of grass and very sweet herbage, and their bellies were full. The pigs ate it voraciously.

On the 19th of January 1789, I weighed the roots again, and then they weighed only 298lb. having lost $42\frac{1}{2}$ lb. since they were taken out of the ground; but this loss of weight is not so very extraordinary, when we consider the juiciness and succulency of the roots when taken up, and the dry and frosty weather we have had ever since, and that they were kept in a dry chamber, covered with straw to preserve them from the inclemency of the weather. They were apparently much drier, but were found and in good preservation, and no ways injured by the frost.

I also

I also planted one other plant (the sixty-seventh) by itself in the garden, by way of trial how it would stand the winter; I left it entirely uncovered and unprotected from all the severe weather we have lately experienced, and I do not find that, in spite of the severest trial it can well be supposed ever to have in this country, it is the least hurt, the main shoot and crown of the plant look vigorous and healthy: many of the leaves, indeed, are dropped down, but not much more than spinach or other common greens are. What this plant weighs I cannot tell, it having never been taken up, but in appearance it seems to be almost as big as the largest of the plants that grew in the bed.

ARTICLE XXX.

On Bees.

[In a Letter to the Society.]

GENTLEMEN,

SOME time since, seeing your advertisement of proposed premiums for encouraging the improvement of bees, a few hints from an old experimenter on these useful insects may, perhaps, contribute to the furtherance of your laudable design.

Premiums

Premiums for the greatest number of stocks seem very liable to cause impositions. I know the London Society suffered such. It is very easy for designing persons to purchase or procure the loan of stocks, from a distance, and therewith to augment their own apiaries, previous to the time of inspection; nor will it often happen, that the signers of their certificates will trouble themselves to make the necessary investigation. Be that as it may, the excitement will influence but few candidates, and not produce such a general emulation among the apiarian farmers, &c. as might be wished. Beside, England is not defective in the production of swarms: Our stocks in general emit too many, which make a great shew in number, but yield a very inadequate proportion of honey and wax, or of stocks fit to stand through the winter and spring. It is certain we have more farina to nourish the broods, than honey to feed them when bred: consequently there are but few apiaries but what may be overcharged. At this place eight stocks is the most we can keep with propriety. At Cheshunt in Hertfordshire, (my late residence) 12 or 14 were the utmost. If none but first good swarms were preserved, and the casts or after-swarms returned back to the stocks, the increase of honey would be many fold greater than in the usual practice of the peasantry,

santry. An incorporated stock will gather more honey than three or four single ones, for reasons obvious to intelligent apiators.

Hives of bees of half a bushel measure, intended to stand, ought at *least* to weigh twenty pounds; larger hives in proportion. Nor ought they to be *above* two years old. Probably, if the number of stocks in one person's possession in January or February were to intitle to the premium, a deception might be more difficult.

To take the honey without destroying the bees, cannot be done by any of the present methods, without trouble, and other instruments than are yet publickly known or in use among the commonality; consequently the peasantry (from whom we must look for a general increase) have neither attempted, nor will attempt a change, where an additional expence is certain, against an uncertain advantage: a few persons of higher station may make a point of pride or interest in benefiting by the premium, whilst the generality will still remain ignorant and incapable. It is with concern I see numbers of sober, honest, and industrious cottagers, with families, to whom a stock of bees would be a little estate, but who out of their small pittance of wages (as here 4s. a week) can never spare enough to

purchase so desirable a resource. A present of a stock to *persons of such characters*, under injunctions of managing them agreeably to the best known methods, might often prove very serviceable, greatly tend to the increase of the article, and would be a species of benevolence and patriotism worthy of opulent individuals and publick societies.

It is much to be lamented as a national loss, that great part of the prime swarms are suffered to escape, from an erroneous opinion about signs and hours of swarming; whereas nothing less than a *constant* watching, from seven to four, can prevent this loss; but which the peasantry will not comply with. For unless we can find a more safe, easy, cheap, and effectual method of swarming bees **ARTIFICIALLY**, the old practice will prevail. I have been experimenting on bees near thirty years, but cannot fully accomplish these grand points; the superior genius of these diminutive artizans baffle the most laboured schemes of an old veteran. However, as they still continue my principal amusement, I shall persevere until I accomplish my design, or the imbecilities of advanced age render me incapable.

A few years since Earl Marchmont honoured me with a present of the celebrated *Schirach's* Treatise
on

on Bees, which produced so much altercation among the naturalists, and apiarian societies in Germany. I have likewise been favoured by T. Dilks, esq; and Lord Torrington, with the principal Memoirs on Bees of the Bruxelles Academy, &c. From these I hoped to have drawn great advantage; but after several years reiterated experiments thereon, to the destruction of many bees, I find them futile, and without *one single result* consonant to, or in favour of, their new doctrines. They may *amuse* the curious, but are of no advantage to publick practice.

As honey is disagreeable, nay hurtful to many constitutions, perhaps it might be worth a trial to procure some honey to be refined as sugar. Mellasses are the gross oily parts of sugar, and being extracted therefrom, it is rendered more wholesome and palatable; if therefore an experiment were made on honey, by a suitable process, it might probably improve both its dietetic and medicinal qualities, adapting it more to general use.

I am, Gentlemen,

Your most humble servant,

Near Pembroke,
June 1788.

JOHN KEYS.

ARTICLE XXXI.

On Bees.

[By the Same, to the Secretary.]

SIR,

IN consequence of your favourable reception, and polite answer, to the letter I ventured to address to the Society last year, I am led to offer the annexed *Caution*, to be inserted in the next volume of the Society's papers, if deemed worthy of such distinction. That it will be conducive to the general benefit of bee-keepers, I am fully and practically persuaded, and I submit to the consideration of the Society, the previous steps of causing it to be inserted, under their sanction, in the country newspapers. If the Bath Society shall incline to give my sentiments their sanction, it will give a weight and dignity to the subject, far superior to the influence of an obscure individual, whose recommendation would be but slightly regarded.

The best time to insert such an advertisement, will be about the middle of March; as then the bees begin to work briskly, and thereby the notice of their owners would be engaged.

The

The loss of the *prime* swarms, which is so common, is in my opinion of greater consequence in the culture of bees, than even that impolitic practice of suffocation, which I have *lately* found reason to think not so very detrimental to the publick interest; as has been imagined.

If the Society should adopt any of my hints, I shall be thankful for a line of communication, or from any member, or experimenter in the apiarian art.

From a treatise which I mentioned in my former letter, *Schirach on the Queen Bee*,* I hoped to have derived much information, as seeming to promise the most essential service; unhappily I have been totally disappointed. He affirms, that all the working bees of a hive, are females in disguise; and that every one of these bees, in an early state of their existence, was capable of becoming a queen: from a knowledge of which, swarms may *artificially* be obtained from the early months of spring, and in any succeeding month, even to November. His experiments have been very numerous; and to obviate every doubt and objection, he performed the operation upon *one, and the same stock*, every four days, for at least *fifty* or *sixty* times; all which pro-

* Pastor of Klein-Bautzen, in Upper-Lusatia, and Secretary to a Society of Naturalists there.

duced young queens, from mere fragments of the combs, &c. &c. This novel and wonderful doctrine excited no little contention and counter-experimenting among naturalists on the continent, without being decided even by the great *Bonnet*. For eight years have I also, with great attention and minuteness, endeavoured to succeed, by *Schirachian* rules; but in the many essays and variations, I never once found such a result as *Schirach* describes. He *asserts*, (which is indeed the grand proof) that the *practice* of this art has already extended itself through Upper Lusatia, the Palatinate, Bohemia, Bavaria, Silesia, and several other parts of Germany, and even of Poland. And yet, surprizing as it may seem, in Britain we have made no such similar improvement, at least, that has come under my notice.

I would not cease pursuing the experiment, were I certain of the above fact, and that thereby a larger quantity of honey and wax has been obtained than by the usual methods before practised in those countries: for a greater number of stocks *only* will not be conclusive. It is the real profit, and not the shew, that we look for.

My humble request, therefore, to the Society is, that if they have formed, or can form a correspondence

spondence in those parts, to obtain a satisfactory investigation of the above points, and will communicate them to me, it will be esteemed as high a favour, and gratefully acknowledged; and, I hope, be converted to the publick benefit.

I am, Sir,

Your very humble servant,

JOHN KEYS.

Near Pembroke, Feb. 6, 1790.

A Caution to the Owners of Bees.

It is a prevailing and general opinion, that bees never *swarm* without *first* shewing some previous signs or tokens; and that they seldom swarm until about the middle of the day. Those who keep bees in the duplicate manner, by setting one hive or box over another, are misled by the writers on bees to believe, that by such kind of contrivance, they are prevented from swarming at all. Both which opinions are assuredly ill-founded. I take upon me to assert, that *one third* of the prime or *first swarms* *escape* unperceived; and that, generally, without the least indication of their design.

The seasons and hours of swarming are also much mistaken: they sometimes swarm in March,
frequently

frequently in April, and from seven in the morning till four in the evening; many rise so early and so late. Nor will a transient viewing of them now and then suffice; one minute shall present no appearance of swarming, and in the next they shall suddenly issue, and fly quite away. Those that are duplicated are equally as prone as those in single straw hives; for *all* will equally pursue great Nature's law, *to swarm*. Without, therefore, a beeherd, or person appointed for *constant watching*, not casually, but without intermission, from seven till four, the proprietor will have his expectations, in a great measure, disappointed. A child or aged person may be hired for the purpose, at the easy charge of 2d. or 3d. a day; whereby, if only *one* swarm be preserved, it will prove an adequate compensation for the expence; besides being sure of losing none of the rest, and the preventing a great deal of anxiety, and often a very fruitless trouble to those who keep four stocks, or more.

From many years assiduous observation, and numberless experiments, I may safely stake my credit upon the truth of my assertions.

Feb. 6, 1790.

JOHN KEYS.

ARTICLE

ARTICLE XXXII.

*On Cyder-Wine, made from the Juice of Apples,
taken from the Press and boiled, according to
a Recipe of Dr. Rush.*

[By ROBERT STEVENS, esq; to the Secretary.]

Ansford near Castle-Cary,

SIR,

Aug. 11, 1789.

WITH the greatest readiness I comply with the request of your Committee, and shall send, next Saturday, a two-gallon cask of Cyder-Wine, drawn from a hoghead I had made under my own inspection, as a trial of the liquor recommended in the Bath Chronicle. I am sorry to observe the directions there given were too scanty, as very little more was said, than that two hogheads of cyder from the press should be boiled down to one, and kept till fit for use, and that in three or four years, according to Doctor Rush's opinion, it would become a pleasant liquor, not unlike Rhenish. The boiling the juice of the apple I conceived could not be all that was necessary to make a vinous liquid—fermentation must somehow be procured, and observation and experience must determine how far that fermentation should be carried. I am certain there is yet much to learn in that particular, and upon that principally the goodness of the liquor
must

must depend. As I have very little doubt, should the analysis intended correspond with the few experiments I have made, but a very wholesome and palatable liquor, approaching to wine, may be obtained from the apple; I submit it to the consideration of your Society how far it may be necessary to offer a small honorary premium, or a pecuniary reward, for the greatest number of experiments to ascertain the best manner of making this wine, and for the best wine produced to a Committee, in a given time. The extraordinary consumption of spirituous liquors, every friend to mankind must lament; and it is a melancholy observation, that the increase of the national revenue is purchased at the expence of the health of so great a part of the community. This evil, I am afraid, can never be totally removed; but I conceive it may be meliorated by the introduction of other cheap and more healthful liquor; at least it may be expected the middling class of people, and those capable of reflection, may be thereby induced to relinquish the use of slow, yet certain poison.

It may not be unnecessary to mention, that in the making I took particular care as to the cleanliness of the copper the apple-juice was boiled in, and which I had immediately from the press.—As soon as this juice was reduced to somewhat less
than

than one hoghead, the liquor was immediately taken out of the copper, and cooled in wooden coolers. When it retained that degree of heat only, in which beer is usually worked, such a quantity of yeast was put in as I imagined would bring on a tolerably brisk fermentation—it fermented pretty strongly during the night following, and the next morning a thick yeasty froth covered the top of the mash-tub in which it was put—the fermentation subsided towards the evening, and, if I recollect, was rather in a negative state the whole day. I think, had the fermentation continued longer, I should have made a more wine-like liquor, that would not have retained so much of the *baked apple-pie taste*, which you will perceive it has, and which it will require some years keeping (if it will bear it) to get rid of.

This year, if I have apples sufficient, I shall make some fresh trials, and shall endeavour at a more perfect fermentation.—Should I have any success, or imagine any thing I may then have done can be serviceable to others, I shall do myself the pleasure to communicate to your Society all the information I am capable of giving.

I am, Sir, your most obedient servant,

ROBERT STEVENS.

[For

[For the laudable endeavours of Mr. *Stevens* to ascertain the important point which had excited his attention, and for his polite manner of addressing the Bath Society, the thanks of a General Meeting were voted to him.—Several Members of the Society were requested to take samples of the liquor sent—make experiments upon it, and report their opinion of its wholesomeness—as also on the Nature and Effects of Cyder, as commonly made and used.—The following paper being presented to the Society, in consequence, by Dr. *Anthony Fothergill*, is here inserted.]

ARTICLE XXXIII.

*Experiments and Observations on Cyder-Wine,
with Remarks on Fruit Liquors, and Hints
for their Improvement.*

[By A. FOTHERGILL, M. D. F. R. S. Bath.]

Vinum tot beneficiis placere cogitur;
Et miramur noxium esse.

PLIN. lib. 14.

PURSUANT to the Society's request, I have examined the cyder-wine prepared after the method communicated by Dr. Rush, as practised in America, viz. by evaporating in a brewing *copper* the fresh apple-juice till half of it be consumed. The remainder is then *immediately* conveyed into a wooden cooler, and afterwards is put into a proper cask,

cask, with an addition of yeast, and fermented in the ordinary way. The process is evidently borrowed from what has long been practised on the recent juice of the grape, under the term of *vin cuit*, or boiled wine, not only in Italy, but also in the islands of the Archipelago, from time immemorial.

It has lately become an object of imitation in the cyder countries, and particularly in the West of England, where it is reported many hundred hogshheads of this wine have already been made; and as it is said to betray no sign of an impregnation of copper by the usual chemical tests, it is considered as perfectly wholesome, and is accordingly drunk without apprehension by the common people; others, however, suspect its innocence. It therefore becomes an object of no small moment to determine, in so doubtful a matter, whether the liquor acquires any noxious quality from the copper in which it is boiled, or not.

The wine sent for my examination was of a red colour, somewhat turbid, and of a sweetish empyreumatic taste, resembling that of a roasted pippin—properties by no means desirable in a vinous liquor, but which doubtless may be considerably meliorated by keeping to a proper age.

EXPE-

EXPERIMENTS.

Exp. 1. VOLATILE ALCALI. Into a small glass of cyder-wine were dropped fifteen drops of volatile spirit of sal ammoniac.—A slight precipitation ensued, the liquor became *darker* coloured, and on standing, a thick cloud of a *greenish* cast settled on the surface. The volatile alcali, whether *mild* or *caustic*, exhibited the *same* appearance.

Exp. 2. PHLOGISTICATED ALCALI. The like proportion of the phlogisticated alcali gave a more visible *green* tinge to the liquor, and on standing produced a variegated *film* on the surface, reflecting the prismatic colours, similar to what is observed in chalybeate waters exposed to the air. At the *bottom* were some particles of a *brown* cast.

Exp. 3. SOLUTION OF ORPIMENT. This liquor which is prepared by chemists under the term of *Liquor vini probatorius*, or *wine test*, when dropped into the cyder-wine, occasioned a slight *cloudiness*, followed by a precipitation of *brownish* particles,

Exp. 4. A fresh portion of cyder-wine being diluted with three times its quantity of fair water, was afterwards tried with the above-mentioned liquors, and then exhibited the different phœnomena *more* distinctly.

Exp. 5.

Exp. 5. A bottle of my own cyder, sent me from a friend in Devonshire as *genuine*, was now subjected to the above chemical tests, that the result might be compared. It however underwent no *material* change, except from the phlogisticated alkali, which gave a faint greenish tinge, but *no* visible *precipitation*.

Exp. 6. POLISHED IRON. A knife-blade being immersed a few hours in a glass of cyder-wine, when dried exhibited a *blackish brown* mark, interspersed with shades of a *copper* colour. The wine at the same time assumed a darker hue, from a slight impregnation of the iron.

Exp. 7. SOLUTION OF VITRIOL OF COPPER—being dropped on the polished part of the blade, when dried gave a similar mark, but of a *brighter* brown.

Exp. 8. RESIDUUM. A pint of cyder-wine being evaporated in a tin vessel to a thick extract, was next placed in a crucible, and, with an addition of tallow, was calcined to a black powder. This *residuum* was examined, and as no metallic particles appeared, a pint of spring water was poured upon it, and after it had stood all night to subside, it was decanted into three separate glasses.

Into

Into the first was dropped some *volatile alkali*; into the second *phlogisticated alkali*; and into the third the *wine test*.

Slight marks of precipitation were barely perceptible in all the glasses, but the dark turbid appearance of the mixture concealed the changes of colour, as it did in some measure in two of the preceding experiments, so as to render the result rather *equivocal*, though they were repeated more than once.

Being curious to know whether the same phenomena would strike other observers in a similar way, I sent a bottle of the cyder-wine to my ingenious friend Dr. *Johnstone* of Worcester, for his examination. His son soon after favoured me with the following letter, containing the result of his experiments, which I have the satisfaction to find agree very nearly with my own.

“ SIR, *Worcester, Sept. 23.*

“ I am desired by my father to acquaint you with the result of some experiments which I have made on the cyder-wine. By them it appears to be *considerably* impregnated with copper.

“ I have the honour to be, Sir,

“ Your obedient humble servant,

“ JOHN JOHNSTONE.”

EXPERIMENTS.

“ 1. A steel pin put into the cyder-wine became of a *brown* colour, which left on the tongue the nauseous astringent taste of *copper*, at the same time the wine became of a darker colour, from some portion of iron dissolved in it.

“ 2. Sal volatile mixed with the cyder-wine made it of a *dark* turbid colour; it occasioned in white-wine a kind of cloud similar to that sometimes observed in urine.

“ 3. Phlogisticated alkali precipitated a dark *brown* cloud very copiously; it had no effect on common white-wine; a clear proof of the presence of *copper* in the cyder-wine.

“ 4. A steel pin put into cyder-wine in which a precipitation had been made by sal volatile, was *not at all* incruusted, nor was its colour in the least changed, though it remained in the wine more than twelve hours.”

Thus far my correspondent.

OBSERVATIONS.

Though a single grain of copper dissolved in upwards of twenty gallons of clear water may be

detected by a visible blue tinge appearing on the addition of a few drops of volatile alkali, yet this is by no means the case in turbid high-coloured liquors, which intercept the rays of light, and often occasion a considerable *deception* in the appearances. Hence the necessity of diluting such liquors in varying the experiments. In no instance did the blue tinge appear with the alkalies, even after the wine was diluted, and yet its absence does *not* prove the liquor to be absolutely *free* from an impregnation of copper. For I afterwards found that it required from three to five drops of a solution of vitriol of copper to give a visible blue tinge to a glass of the liquor. The alkalies gave a greenish tinge to the wine; and copper, in form of verdegris, assumes indifferently a green or blue colour, according to circumstances.

If the mark on polished iron was darker than that which is produced by vitriol of copper, it was evidently owing to a small portion of the *iron* dissolved at the same time, and which always imparts a *blackish* tinge to polished metals.

If the liquor was free from any metallick impregnation, why did it yield a *precipitation*?—a *variegated film*?—a *brown sediment*? And why did it afford

afford such a striking contrast, when compared with genuine cyder, or white-wine?

When the metallick principle was precipitated by an alcali, the wine *no* longer gave the brown *coppery* tinge to the steel pin, and that for an obvious reason. Copper unites with an alcali rather than with iron.

On the whole, if we may rely on the above experiments, does not the general result afford a strong presumption, if not a proof, that the cyder-wine contains a minute impregnation of copper? Not so *considerable*, nor yet so very *palpable*, (it is to be hoped) as my ingenious correspondent seems to imagine, but yet sufficient to put the publick on their guard concerning a liquor that comes in so very '*questionable a shape.*'

It is a curious chemical fact, if it be really true, that acid liquors, while kept *boiling* in copper vessels, acquire little or *no* impregnation from the metal, but presently begin to act upon it when left to stand in the *cold*. Can this be owing to the agitation occasioned by boiling, or the expulsion of the ærial acid? Atmospherick air powerfully corrodes copper, probably through the intervention of the ærial, or rather nitrous acid, for both are now acknowledged to be present in the atmosphere. But

the latter is doubtless a much stronger menstruum of copper than the former.

In the present process, the liquor is properly directed to be passed into a *wooden cooler*, as soon as the boiling is completed. But as all acids, and even common water, acquire an impregnation, and unpleasant taste, from standing in copper vessels in the *cold*, why may not the acid juice of apples act in some degree on the copper *before* the boiling commences? Add to this, that brewing coppers, without far more care and attention than is generally bestowed on them in keeping them clean, are extremely apt to contract verdegriis, (a rank poison) as appears from the blue or green streaks very visible when these vessels are minutely examined. Should the unfermented juice be thought incapable of acting on the copper, either in a cold or boiling state, yet no one will venture to deny its power of washing off, or dissolving verdegriis *already formed* on the internal surface of the vessel. Suppose only one-eighth part of a grain of verdegriis to be contained in a bottle of this wine, a quantity that may elude the ordinary tests, (for reasons already assigned) and that a bottle should be drunk daily by a person without producing any violent symptom, or internal uneasiness, yet what person in his senses would knowingly chuse to hazard the experiment

riment of determining how long he could continue even this quantity of a slow poison in his daily beverage, with impunity? And yet it is to be feared the experiment is but too often unthinkingly made, not only with cyder-wine, but also with many of the *foreign* wines prepared by a similar process. For the grape juice, when evaporated in a copper vessel, under the denomination of *vino cotto*, or boiled wine, cannot but acquire an equal, if not yet stronger impregnation of the metal than the juice of apples, seeing that verdegris itself is manufactured merely by the application of the acid husks of grapes to plates of copper.

Independent of the danger of any metallick impregnation, it may be justly questioned how far the process of preparing boiled wines is necessary, or reconcileable to reason, or œconomy.

The evaporation of the *must* by long boiling not only occasions an unnecessary waste of both liquor and fuel, but also dissipates certain *essential* principles, without which the liquor can never undergo a complete fermentation, and without a complete fermentation there can be no perfect wine. Hence the boiled wines are generally crude, heavy and flat, liable to produce indigestion, flatulency, and diarrhœa. If the evaporation be performed *hastily*,

the liquor contracts a burnt empyreumatick taste, as in the present instance; if *slowly*, the greater is the danger of a metallick impregnation. For the process may be presumed to be generally performed in a vessel of brass, or copper, as few families possess any other that is sufficiently capacious. Nor can a vessel of cast-iron, though perfectly safe, be properly recommended for this purpose, as it would probably communicate a chalybeate taste, and dark colour to the liquor. At all events brass and copper vessels ought to be entirely banished from this and every other culinary process. The mischievous consequences resulting from metallick poisons, and particularly of lead and copper, are, I am convinced, more numerous and extensive than is commonly imagined. The evil has long been loudly complained of, and yet the people of this country continue to sacrifice their health, and lives, to the most unpardonable negligence and supineness, even when the remedy is at hand. But I shall reserve my strictures on this subject for a future paper.

Remarks on CYDER and PERRY.

Before I conclude, it may not be improper to add a few observations on the present state of fruit liquors in our cyder counties, the improvement of which is an object of great importance to the publick,

lick, but particularly so to the inhabitants of those districts where these liquors constitute their common beverage. Cyder and perry, when genuine, and in high perfection, are excellent vinous liquors, and are certainly far more wholesome than many others which at present are in much higher estimation.

When the *must* is prepared from the choicest fruit, and undergoes the *exact* degree of vinous fermentation requisite to its perfection, the acid and the sweet are so admirably blended with the aqueous, oily, and spirituous principles, and the whole imbued with the grateful flavour of the rinds, and the agreeable aromattick bitter of the kernels, it assumes a new character; grows lively, sparkling, and exhilarating; and when compleatly mellowed by time, the liquor becomes at once highly delicious to the palate, and congenial to the constitution. Superior in every respect to most other English wines, and perhaps not inferior to many of the best foreign wines.

Such I can venture to affirm would it be pronounced by all competent judges, were it not for the popular prejudice annexed to it as a cheap, home-brewed liquor, and consequently within the reach of the vulgar. To compare such a liquor
with

with the foreign fiery, sophisticated mixtures, often imported under the name of wines, would be to degrade it; for it certainly surpasses them in flavour and pleasantness, as much as it excels them in wholesomeness and cheapness. But rarely do we meet with perry or cyder of this superior quality. For what is generally sold by dealers and innkeepers is a poor, meagre, vapid liquor, prone to the acetous fermentation, and of course very injurious to the constitution. Is it not very mortifying, after the experience of so many centuries, that the art of preparing these ancient British liquors should still be so *imperfectly* understood as yet to seem to be in its very infancy;—that throughout the principal cyder districts, the practice should still rest on the most vague, indeterminate principles, and that the excellence of the liquor should depend rather on a lucky *random* hit, than on good management? Yet such appears to be really the case even among the most experienced cyder-makers of Herefordshire and Gloucestershire!

Mr. Marshall, that nice observer of rural affairs, in his late Tour through those counties* (expressly undertaken for the purpose of inquiry on this subject) informs us, that scarcely two of these professional artists are agreed as to the management

* Marshall's Rural Economy of Gloucestershire, ii. 308 & seq.

of some of the most essential parts of the process. That palpable errors are committed as to the time and manner of gathering the fruit—in laying it up—in neglecting to separate the unsound—and to grind properly the rinds and kernels, &c. That the method of conducting the vinous fermentation, the most *critical* part of the operation, and which stamps the future value of the liquor, is by no means ascertained. While some promote the fermentation in a spacious open vat, others repress it by inclosing the liquor in a hoghead, or strive to prevent it altogether. That no determinate point of temperature is regarded, and that the use of the thermometer is unknown, or neglected.—That they are as little consistent as to the time of racking off, and whether this ought to be done only once, or five or six times repeated. And that for fining down the liquor, many have recourse to that odious article, bullock's blood, when the intention might be much better answered by whites of eggs, or isinglass. And finally, that the capricious taste of particular customers is generally consulted, rather than the real excellence of the fruit wine, and consequently that a very imperfect liquor is often vended, which tends to reduce the price, to disgrace the vender, and to bring the use of cyder and perry into disrepute.

The art of making vinous liquors is a curious chemical process, and its success chiefly depends on a *dexterous* management of the vinous fermentation, besides a close attention to sundry minute circumstances, the theory of which is perhaps not yet fully understood by the ablest chemists. Can we longer wonder then that so many errors should be committed by illiterate cyder-makers, totally unversed in the first principles of the chemical art? Some few indeed, more enlightened than their brethren, and less bigoted to their own opinions, by dint of observation, strike out improvements, and produce, every now and then, a liquor of superior quality, though perhaps far short of excellence; yet still sufficient to shew what might possibly be accomplished by a series of new experiments conducted on philosophical principles.

This might lead to successive improvements, till at length our English fruit liquors might be carried to a pitch of perfection hitherto unknown, by which the demand, both at home and abroad, would soon be enlarged, the prices augmented according to the quality, the value of estates increased, and the health and prosperity of these counties proportionably advanced.

This

This might also help to point out a method of correcting the imperfections of these liquors; and of meliorating those of a weak, meagre quality, by safer and more effectual means than are now practised: and though nothing can fully compensate the defect of sun-shine in maturing the saccharine juices, in unfavourable seasons, yet probably such liquor might, without the dangerous and expensive method of boiling in a copper vessel, admit of considerable improvement by the addition of barm or other suitable ferment, as yet unknown in the practice of the cyder districts; or perhaps rather by a portion of rich *must*, or some wholesome sweet, as honey, sugar-candy, or even melasses, added in due proportion, previous to the fermentation.*

Now, should this Society interest themselves in the present inquiry, in which this and the adjacent counties are materially concerned, might it not be adviseable to offer a suitable premium to stimulate the cyder-makers to undertake such a course of experiments as may seem proper towards the im-

* Since the above was written, I learn from a recent publication, that the Germans are known to meliorate their thin harsh wines by an addition of concentrated Must, not by evaporation, but by *freezing*. By this simple process they are made to emulate good French wines—a practice worthy imitation, especially in the Northern climates.

See HOPSON'S Chemistry.

provement

provement of perry and cyder, and also for correcting, or meliorating these liquors when prepared from an unripe or inferior fruit ?

It is greatly to be regretted that the capital old fruits, which raised the fame of the liquors of this country, are now chiefly lost, or so far on the decline, as to be deemed irrecoverable.

Mr. Marshall, in his late survey of the orchards in Herefordshire, assures us that the *redstreak* is given up: the celebrated *fire* apple is going off; and the *squash* pear, which has probably furnished this country with more CHAMPAIGN than was ever imported into it, can no longer be got to flourish; the stocks canker and decay.

In Yorkshire several fine old fruits, which were productive within his own recollection, are lost; the stocks cankered, and the trees barren.

The famous *Hagloe* crab, which yields a cyder that for richness, flavour, and price on the spot, surpasses perhaps every other fruit liquor, having been valued at sixty guineas the hogshead, is confined to a small district near Ross in Herefordshire,*

* Rural Oeconomy of Gloucestershire, Herefordshire, &c.
vol. ii. page 253.

and will probably in a few years be extinct. Is it not surprizing that the cultivation of such excellent varieties of fruit-trees should be thus limited to a few particular counties, and so much neglected even in these; when probably, by due attention to soil, aspect, and other leading circumstances, they might be successfully raised, and propagated in almost any quarter of the kingdom?

That fruit liquors, when of a good quality, and drunk with moderation, afford an uncommonly wholesome and cheap beverage, is allowed on all hands, and confirmed by long experience.

Nor can any arguments against its utility be fairly drawn from its abuse, or from the evils that necessarily ensue from the enormous quantities of bad cyder consumed by day-labourers.

In the vale of Gloucester, says Mr. Marshall, six quarts a day is the common allowance; sometimes nine or ten quarts; or an unlimited quantity! In a plentiful fruit year cyder is of very little value: men and masters are equally adepts in the art of drinking; and the tales that are told of them appear so incredible, it is to be hoped they are not strictly true. Drinking a gallon-bottle-full at a draught, is said (on good authority) to be no uncommon feat:

feat:—a mere wanton trick that will not bear to be bragged of. But to drain a two-gallon bottle without taking it from the lips, as did a certain labourer, is spoken of as an exploit worthy an inhabitant of the Vale of Gloucester!—Another man of the Vale, however, undertook for a trifling wager to drink twenty pints of cyder, one immediately after another. He got down nineteen, (as the story is gravely told) but these filling the cask to the bung, the twentieth could not of course get admittance: so that a Severn-man's stomach holds exactly two gallons three pints!—But the quantity drunk in this extemporaneous way by the men is trifling, compared with that which their masters will swallow at a sitting. Four well-seasoned yeomen (well known in the Vale) having raised their courage with the nectarious juice of the apple, resolved to have a fresh hogshhead tapped; then setting foot to foot, they entirely emptied it at one sitting!*

Concerning the effects of such extravagant feats performed by those mad toppers, our author is silent; but if similar debauches are frequently committed with impunity (which seems scarcely credible), they afford a striking example of the salubrity of cyder, perhaps not to be paralleled by any other vinous or fermented liquor. At all events such wanton

* Oeconomy of Gloucestershire, vol. i. p. 53.

excesses ought by every possible means to be discouraged. But to the disgrace of our police, the law which inflicts penalties on drunkenness, instead of being strictly executed, is generally suffered to remain a dead letter. Meanwhile, I fear it will be in vain to admonish these thorough-paced soakers—or attempt to deter those brutes in human shape from pursuing the high road to ruin! In vain shall we strive to convince them that a habit of drinking learnt in youth, is not easily abandoned in riper years, and that a continued abuse of even the most innocent fermented liquor, will, in the long run, infallibly prove a slow, but fatal poison!

ARTICLE XXXIV.

On the Poison of Lead, with Cautions to the Heads of Families concerning the various unsuspected Means by which that insidious enemy may find Admission into the Human Body.

[By the Same.]

Hinc dira tormina!—Hinc genæ pendulæ, tremulæque manus!

PLIN.

TO call forth latent abilities, and to promote a generous emulation amongst our husbandmen, manufacturers, and artizans, is the professed object of the Bath Society. But while we thus endeavour

endeavour to enlighten the minds, and to kindle the zeal of the common people, ought we not to instruct them moreover in the necessary means of preserving their health? Without this, how shall we enable them to encounter with alacrity their laborious pursuits? Without health the daily task cannot be performed. The plough and the team lie useless—the busy loom becomes silent—and all the œconomical arts languish! Till confined to the bed of sickness, this useful class of people are of all others the most inattentive to their health. It is not till then that they begin to be truly sensible of its value, and then with heartfelt sighs they deplore its absence! Each rural scene that lately delighted the senses, has on a sudden lost all its charms, and the gay face of nature is now beheld with an eye of indifference, or even disgust.

For what are fields, or flow'rs, or streams to me,
 Ah! tasteless all, if not enjoy'd with THEE,
 O HEALTH!————

It is always much easier to prevent diseases than to cure them. Therefore to impress the common people with a due sense of the importance of their health, and to put them on their guard against one of the most frequent, though unsuspected causes of many of their chronick diseases, is the business of this essay.

The

The mischiefs arising from culinary poisons present a wide field for discussion; but I shall confine myself at this time, *to the poison of Lead*. Is it not a moving spectacle to see poor industrious tradesmen, particularly the manufacturers of red and white lead, daily exposed to the noxious fumes of this pernicious metal? Unhappy men, whose hard lot it is to earn, by the sweat of their brow, a scanty maintenance, breathing all the while a tainted air, and inhaling a slow poison at every pore, in order to prolong a wretched existence! These surely have a peculiar claim to our compassionate regards, and I should think myself happy if I could awaken the attention of this Society towards the alleviation of their sufferings.

The London Society have not been inattentive to this great object, as appears from their late premiums, particularly concerning a substitute for white lead, or a method of divesting it of its deleterious quality;—an object highly worthy your consideration, as this noxious substance constitutes the basis of all our common paint, the injurious effects of which are universally complained of.

The extensive use of lead in various forms, enables it to assail all the avenues of life.—Sometimes it attacks the human frame by an open

assault, but more frequently it makes inroads into the constitution as a secret unsuspected enemy. Various causes conspire to favour its introduction into the system. The arts of chemistry, of medicine, and even of cookery, have all successively lent their aid; insomuch that no person of whatever rank or station, from the prince to the peasant, can at all times pronounce himself perfectly secure against its silent depredations. Devoutly therefore, not ludicrously, may we now exclaim with Sir John Falstaff,

“Heavens, keep lead out of us!”

The jovial knight, like a *bon-vivant* of the present day, not dreaming of its admission into his body by any mode but one, viz. that of a leaden-ball, continued to quaff his sack in seeming security, while each draught probably contained a portion of the detested metal which he so piously deprecated. For our ancestors in those days were no novices in the mystery of refining liquors with lead, though by no means such able adepts as their successors, who (to do them justice) appear to have carried the art to its *ne plus ultra*.

But to be serious:—Though the above apprehensions to some may seem imaginary, or at least exaggerated, yet whoever attentively considers the well-authenticated facts adduced by Sir George Baker,

Baker, Dr. Percival, and other eminent authors, concerning this poison, will soon be convinced that they are but too well founded, and consequently that these cautions are not altogether superfluous. Seldom do the common people err through excess of caution, but often through the want of it. Few of them indeed have leisure or inclination to trace this subject through a variety of medical volumes, who nevertheless peruse, with eagerness, the Society's papers, or other short essays in which they consider themselves to be materially interested. The following admonitions, therefore, are not addressed to the medical faculty, but to the heads of families, whose duty it is to watch over the health of those who are committed to their charge.

GENERAL EFFECTS
OF THE
POISON OF LEAD.

LEAD in every form is unfriendly to animal and vegetable life. The miners who dig the ore, the smelters who reduce it to a metallic state, manufacturers of white lead, painters, plumbers, in a word, all who are much exposed to its effluvia, bear testimony to its pernicious effects. Its fumes

are found no less destructive to domestick animals, such as dogs, cats, fowls, &c. nay, even vegetables in its neighbourhood soon lose their verdure; nor can plants thrive in pots composed of this metal. Its various preparations, as litharge, red and white lead, are all poisonous, and their activity is increased by their union with acids. Lead unfortunately being thus liable to be corroded, or even dissolved, by almost every species of acid, the dangerous consequences are proportionably increased. For it not only unites with the stronger mineral acids, but also with those of the weaker vegetable kind, as that of wine, beer, cyder, vinegar, verjuice, &c. to which it imparts a manifest sweetness, forming a salt termed sugar of lead. Hence the foundation of that most dangerous abuse of correcting acid wines and cyder with litharge, or other preparations of this metal. Lead also unites with expressed oils, and other unctuous bodies, as butter, fuet, lard, &c.

Hence in Holland it has been customary to correct the more offensive expressed oils, so as to substitute them for oil of olives, or almonds, by impregnating them with lead.—Another horrible abuse, and which merits the most exemplary punishment! Deliberately thus to adulterate the common articles of life with a slow poison, and wantonly

to sacrifice the lives of innocent persons to unfeeling avarice, seems a refinement in villainy at which human nature revolts, and which could hardly be credited in a Christian country! The savage tribes of the most barbarous nations, who attack their declared enemies with poisoned arrows, are never known to discharge them at their unoffending neighbours and countrymen.

To such an alarming pitch had the dangerous art of adulterating liquors with lead arrived in France, that at length it became necessary to make it a capital offence. I am unwilling to believe that any man would presume to practise this inhuman fraud, were he fully apprized of the poisonous nature of the ingredient. That none of my readers may plead ignorance, I shall briefly mention its principal effects.

This metallick poison then is powerfully styptick, and highly injurious to the nerves, hence it suppresses the natural intestinal discharges, producing obstinate costiveness, and a peculiar species of colick terminating in palsy of the extremities, which generally deprives them of motion, without destroying their sensation. These symptoms, being the genuine effects of lead, seem to mark its specifick power, and to distinguish it from every other poison.

It moreover occasions a pale fallow countenance, contraction and wasting of the muscles, numbness, tremors, languors, convulsions, epilepsy, and death.—These symptoms vary according to the quantity of the poison, the state of the body, the irritability of the system, and other circumstances. Sometimes, without producing spasms or other violent symptoms, it only occasions a slow lingering indisposition, which, however, lasts some years, and at length generally eludes the power of medicine. This well accords with what has been transmitted to us concerning the slow poisons of the ancients, and seems to confirm the suspicion that their basis was no other than a secret calx of lead.—May this fatal calx long rest in oblivion, and never more be revived!

Various ways in which it is admitted into the Body.

This poison may be received into the body in diet, and in medicine.

1. *Diet.*—Water, which constitutes so large a proportion of diet in every nation, is generally conveyed through leaden pipes, or cylinders of pumps, and is often left to stand in leaden cisterns. As these have sometimes been found corroded in certain places, by *Newman* and other chemical writers,

writers, it has been suspected, and not without reason, that the water might thus receive a slight impregnation from the metal.—*Galen* and *Vitruvius* loudly condemn leaden pipes for the purpose of conveying water, because their internal surface contracts a covering of white lead. *Dr. Heberden* kept water in which lead had been immersed twelve years: the water exhibited a whitish powder at the bottom, and gave a brown tinge to a solution of orpiment, and volatile tincture of sulphur—proofs of the presence of lead. *Sir George Baker*, however, repeated the experiment by keeping water in a leaden tube, but at the end of two months the water discovered no sensible impregnation by the above tests. He relates however, on the testimony of *Dr. Wall*, that a family in Worcester suffered a long tedious indisposition, with some symptoms of this poison, in consequence of daily using a hard aluminous water. On examining the pump, the leaden cylinder was found corroded, and even perforated by the water, although it had been repaired only three years before. On removing to another house supplied with better water, the family at length recovered their wonted health. From these facts it would appear, that water, under certain circumstances, is capable of corroding lead, so as to prove injurious to health. Some authors affirm, others

others positively deny this conclusion. Pure water, it is true, is no menstruum for lead, but rarely do we meet with water that is pure. Pump or spring water is generally impregnated with a small portion of vitriolick or marine salt, but lead is hardly capable of detaching these acids from an alkaline or earthy basis, and therefore cannot communicate any poisonous quality to the water: hence this metal, though immersed in a solution of alum, remains unchanged. Nor can the aërial acid enable water to act upon lead. But should the water contain any mineral or vegetable acid, uncombined with earth, a circumstance which rarely occurs, it may then, though in a very dilute state, corrode the metal sufficiently to produce mischievous effects. This seems actually to have been the case at Worcester. For it certainly must have been an acid, not alum, that corroded the lead.—This may suggest to us the following cautions:

1st. That whenever water betrays any sensible mark of acidity, by an aluminous taste, or by changing syrup of violets red, such water, if meant for internal use, ought never to come in contact with lead.

2dly. Water conveyed from the leaden gutters of houses, or standing long in leaden cisterns exposed to

to falling leaves, from which it may acquire an acid quality, is alike exceptionable. To this cause, *M. Tronchin* attributed the epidemick colick which some years ago prevailed at Amsterdam.

WINES.—It is worthy observation, that the endemial colick, which formerly was wont to infest the inhabitants of Poitou, so as to become proverbial, is now no longer known, since the practice of adulterating wines has been abolished from that district. In whatever country the liquors are impregnated with lead, either by accident or design, this disease will be found to prevail, as will, I think, more fully appear in the sequel. Hence the colick of Poitou, and of Devonshire, and the dry belly-ache of the West-Indies, (whatever some may assert to the contrary) are evidently one and the same disease, and may clearly be traced to the same cause, namely, the poison of lead.

Notwithstanding the severity of the laws, the fatal abuse still prevails, particularly in many parts of France and Germany, where their weaker wines, being prone to acidity, are still, in defiance of all laws, human and divine, corrected with litharge, or sweetened with sugar of lead! Nor is this wholly confined to the lower white-wines, such as the Rhenish, and the Moselle, for in a late French publication,

publication, intituled *LA MAISON RUSTIQUE*, a large ball of lead is piously directed to be suspended in the cask, in order to prevent the wines of *Burgundy* from turning acid! At Paris, the low meagre wines commonly sold to the populace are made to run through a leaden channel, and are distributed to the customers in measures composed of tin, or base pewter, containing a large portion of lead. Accordingly the colick of Poitou is still predominant in Paris. *Dr. Gadane* computes the average number of inhabitants annually afflicted with this disease to amount to five or six hundred. *M. Senac*, late physician to the King of France, adds his testimony concerning the frequency of the disease at Versailles. *Dr. Warren* enumerates thirty instances among the servants and domesticks of an English nobleman, during his residence at Hanover, all occasioned by the same cause. It has been observed with surprize that, at Surinam, the Europeans who drink French wines are extremely liable to this disease, while the natives, who refrain from this beverage, entirely escape.

If we turn our attention to our English *made* wines, I fear they will by no means be found clear of suspicion. In Graham's art of making British wines, are the following choice receipts:

1. *To soften Green Wine.*

Put in some vinegar wherein *litharge* has been well steeped, and put a quart of it into a tierce, and this will mend it, in summer especially.

2. *To hinder Wine from turning sour.*

Put a pound of melted lead in fair water into your cask pretty warm, and stop it close.

From which it appears that William Graham was deep in the mystery of vintners: and his book having gone through no less than six editions, may be reasonably supposed to have revealed the dangerous secret of those adepts in iniquity, to at least three thousand innocent families, together with their friends and connections! But to estimate the sum total of mischief accruing from the numerous receipt-books of this stamp published within these fifty years past, “highly necessary (as the editors gravely observe) to ALL FAMILIES,” entirely baffles calculation! For, according to the sage advice of those worthy authors, scarcely any family is now found without one or more of their “faithful guardians of health, or trusty monitors in every thing relating to food or physick!”

To supply the publick with an effectual antidote to the various poisons conveyed in these books, and disseminated far and wide amongst the people, would
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be worthy the pen of the ablest chemist, and every life thus rescued from their pernicious effects would well intitle him to a civick crown.

RUM.—The dry belly-ache, or in other words, the colick of Poitou, is a prevailing disease in the West-Indies, particularly among those who drink rum. Some attribute it to the newness of the spirit, others to the acid juice of the limes which generally accompanies its use. But the former, when genuine, is inadequate to the effect; the latter, instead of producing the disease, is found rather to be a remedy.

Dr. John Hunter, in the year 1781, being stationed with the army at Spanish-town in Jamaica, finding this disease very prevalent amongst the foldiers who drank *new* rum, while others who abstained from it remained free, began to examine closely the liquor, and also the implements used in the distillery. The rum, in his experiments, gave evident signs of an impregnation of lead. The worm of the still, consisting of a large proportion of lead, he found corroded. An acid residuum called *dunder*, it seems, is added to the mixture before distillation, and partly rises with the spirit. No wonder then that the lead was corroded by it. The spirit, in process of time, in a great measure deposits

deposits the lead, hence old rum is found much less unwholesome than new. If rum be left to evaporate in a glass it leaves an acid remnant behind. He further adds, that if a piece of lead be immersed in *pure* proof spirit the space of ten weeks, the liquor is found to have acquired a slight impregnation from the metal—A new and singular circumstance; but which, I believe, never can take place where *pure* spirit is employed.

The nitrous acid is sometimes clandestinely used to correct ill-flavoured rum, and such an adulterated spirit may be readily conceived capable of acting on lead, though *pure* spirit certainly cannot. Hence it is easy to see how the above deception in the Doctor's experiment might tend to mislead his judgment. Distilleries, and even breweries, with all their apparatus, ought to undergo a narrow inspection, as acids, and even their effluvia, are capable of corroding lead. Therefore the leaden worms, spouts, gutters, in a word every utensil containing that metal, ought to be viewed with a jealous eye. Nor ought the enquiry to be confined to these places alone: for if we extend our views to our wine and cyder-presses—dairies, kitchens, and store-rooms, we shall probably meet with much to be complained of—much to be reformed. Whether the apothecary's shop, or even the

the elaboratory of the chemist, will bear a very close scrutiny, may perhaps be justly doubted. For be it remembered, that not only lead and pewter, but also the tinning of copper vessels, the folder containing a mixture of lead, and the glazing of earthen ware being a calx of lead, are all liable to be corroded by acids, or even expressed oils.

CYDER.—That acid wines or crude cyder may, independent of any adulteration, produce bowel complaints, attended with griping pains, and diarrhea, cannot be denied, but that they should occasion a colick, complicated with costiveness, and terminating in palsy, is highly improbable. On the contrary, that this disease is the genuine produce of the poison of lead seems to have been proved by the most satisfactory evidence. The Endemial colick of Devonshire, ascribed by *Dr. Huxham* and others, to the acidity of new cyder, has at length been clearly traced to the above poison.

From the elaborate essays of *Sir George Baker* on this subject, it appears, that, “in those districts where the disease was most prevalent, lead was generally found in the presses or utensils employed in making the cyder, and that on analysing the suspected liquor, he obtained from it a small portion
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of *real* lead:* That some of the farmers had been known to buy sugar of lead to correct the acidity of their cyder! That others, in order to preserve their weak cyder for the use of their labourers, were wont to have recourse to the well-known secret of suspending a leaden ball in the cask: That the cyder is generally drawn into large *glazed* pitchers, in which it often stands many hours before it is drunk by the labourers: And finally, that according to the testimony of the late *Dr. Charlton*, most of the paralyticks recommended to the Bath Hospital were sent from the cyder counties, except Herefordshire, where, on enquiry, it was afterwards discovered that lead was not employed in any part of the cyder apparatus of that county."

Since the above was written, however, I am sorry to find, from *Mr. Marshall's* late survey of the Cyder-process in Herefordshire, that lead is not

* This, I am not ignorant, has been ludicrously attributed, by some of his Devonshire antagonists, to leaden shot accidentally left in the bottles before the cyder was bottled: By others, to a portion of lead introduced by design, in order to raise a laugh at the Doctor's expence. But admitting so accurate an observer could so easily be imposed upon, (which is highly improbable) yet the doctrine rests not on this experiment alone, but on a series of facts which will still remain unshaken; and which, perhaps, will not be found easy to overturn.—For the circumstances have been communicated by different authors at different periods, and without the slightest appearance of collusion, and yet all tend to the same point.

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wholly discarded, but a portion of the old leaven is yet suffered to remain. “ The bed or floor of the
 “ presses, (says he,) which is now generally composed
 “ of wood or stone, formerly was usually covered
 “ with lead, which, by being dissolved in the *acid*
 “ of the liquor, has probably been the cause of
 “ much mischief. Nevertheless, lead is still suffered
 “ to remain about some cyder-presses. There is a
 “ publick mill at Newnham, whose bed is *entirely*
 “ covered with lead; and I have seen others whose
 “ lips, or spouts, and a rim round the outer edge,
 “ are of that dangerous metal!”*

A striking instance of ignorance, obstinacy, and impolicy! otherwise a practice so injurious to health, and detrimental to the credit of the liquor, would not be thus absurdly persisted in. I know it is pretended that the quick passage of the apple juice through such spouts or gutters does not afford time for any impregnation. But this is a mistake, for the leaden surface being often wetted, and alternately dried by exposure to the air, contracts minute particles of ceruss, or rust of lead, ready to be washed off, and dissolved in the course of the process. Sometimes the juice is even suffered to ferment in vessels lined with lead, which still greatly

* Rural Oeconomy of Gloucestershire, Herefordshire, &c. p. 313.

increases

increases the danger. An instance of this kind lately occurred at Frome:—A family of three persons drank freely of this liquor, and were at length seized with the colick of Poitou. The master who drank the greatest quantity, suffered most, and his disease terminated in a fatal palsy;—the wife and maid-servant, who drank less, underwent similar symptoms, but escaped with life.

It is high time that this, and the still more unpardonable abuse of wilfully adulterating cyder with lead, should be wholly suppressed;—that an enquiry should be set on foot through all the cyder districts, that such practices may be detected wherever they exist; and that the colick of Poitou may no longer be emphatically stiled the colick of Devon.

MILK and CREAM.—The vessels of our modern dairies consist chiefly of lead, or earthen-ware glazed with a calx of that metal, both which are liable to be corroded by weak acids, and oily substances. Whether the milk and cream are suffered to remain in them long enough to acquire an impregnation of the metal, has not been determined: but the acid odour which strikes the nostrils on entering certain dairies, especially in a warm season, is at least sufficient to excite suspicion, and

to put the publick on their guard till the safety of these vessels be more fully ascertained. My late ingenious friend *Mr. Hayes* has already offered some judicious strictures on the abuse of these vessels in dairies, and mentioned others as proper to be introduced in their place.*

But if vessels of cast-iron, which he proposed to substitute for leaden ones, should be found to impart an unpleasant colour or chalybeate taste to the milk, (as we have reason to apprehend) it will prove an insuperable objection to their use. After all; the wisest step would be to return to the ancient wooden bowls of our ancestors, than which nothing can be more perfectly safe or free from suspicion.

VINEGAR, PICKLES, ACID FRUITS, &c.—These act powerfully upon lead and its preparation, and, it is to be feared, often acquire an unsuspected impregnation of that metal in various culinary processes. Thus when vinegar is distilled in a pewter alembick, or passes through the worm of a common still, it carries with it a portion of the metal. The process ought therefore always to be performed in stone or glass vessels.—It is a very common, but dangerous mistake, to suppose that vinegar may be

* See the Bath Society's Papers, vol. iv. art. 10.

trusted to glazed earthen-ware with perfect safety, since vegetable acids act more forcibly on the calces of lead than on the metal itself; hence the severe colicks often brought on in time of harvest among the poor labourers, from drinking cyder after standing but a few hours in glazed pitchers.†

Yet glazed earthen-ware, in a variety of forms, constitutes the vessels in which pickles are kept; in which acid fruits are preserved; and in which various kinds of tarts are baked. It is moreover curious to observe, that a marked preference is given to them by most frugal housewives, who find by experience that such vessels occasion a material saving in the article of sugar:—but they remain to be told, that the increased sweetness proceeds from the acid of the fruit being blunted by its union with the glazing of the vessel, which has a more pernicious tendency than they seem to be aware of. For certainly these good ladies would not designedly sweeten our viands with sugar of lead!

Here it ought to be remarked, that there is a material difference in the mode of glazing vessels. The glazing of *stone* ware and china, being a vitrification of the clay, is indissoluble in acids, there-

† London Medical Inquiries, vol. v. p. 404.

fore such vessels are perfectly safe; while the glazing of ordinary *earthen-ware*, consisting of a calx of lead, is easily acted upon by acids, and yields a noxious quality.

The same remark is in some measure applicable to vessels lined with tin. Pure block-tin, it is true, gives no impregnation to vinegar or acid juices, but the generality of tinned vessels contain a considerable alloy of lead, besides what is used in the solder. This is very distinguishable even by rubbing a finger over them, which will soon acquire a blackish hue from the lead; a circumstance worthy notice, as too much confidence is generally placed on the safety of tinned vessels. Not to mention the danger of the tin lining soon wearing off, and leaving a copper surface exposed. Hence the fatal accidents that have ensued from acid sauces and gravy soups standing too long in such vessels, and acquiring thereby an impregnation doubly dangerous. For here the poison of lead, and verdigris, combine their united forces to undermine the human frame!

The Dutch have been accused of correcting the rancidity of oils, and even butter, by pouring melted lead into them. If this be true, the ordinary practice of preserving salted-butter or hog's lard in glazed earthen

earthen vessels for kitchen use, may indeed diminish their tendency to rancidity, but not without communicating a more dangerous quality.

But what shall we say to the still more hazardous practice of chemists and apothecaries, who, till very lately, have been sanctioned by no less authority than that of the College Dispensatory to boil their oxymels, composed chiefly of honey and vinegar, in *glazed* earthen vessels, for such the words "*vase fictili vitreato*" plainly import! And it is much to be feared the direction will continue to be literally obeyed by those who are still ignorant of its dangerous tendency. Such an oversight cannot be supposed long to have escaped the notice of that learned body; but is it not strange they should suffer this, and some other obvious blemishes, to disgrace one of the most elegant Dispensatories in Europe, from the year 1746 till the new edition of 1788, wherein I am glad to find them expunged, and that glass vessels only are expressly ordered for such purposes in future? The old pewter funnels and measures, however, still continue to be found in almost every shop. Into these are poured, without hesitation, vinegar and other acids; and the vessels sometimes, through hurry, are set by unwashed. On exposure to the air for some time, a fine efflorescence of sugar of

lead is formed on the inner surface, ready to sweeten the next draught or julep that happens to be poured into them.

TEA is imported into this country in chests lined with sheet lead.—This, like other vegetables, contains a weak acid, which quality is probably heightened by a latent fermentation which tea undergoes when damaged by moisture. May it not in this state act on the metal? How far the tremors, depression of spirits, and other nervous symptoms generally ascribed to this vegetable, or the hot water in which it is infused, may not, in such instances, with equal probability be attributed to the lead in which it is inclosed, is left for future observation.

SATURNINE MEDICINES.—Lead, though a poison, yet in skilful hands is capable of being rendered an useful medicine, and therefore is still properly allowed to retain a place in the Dispensatory. As a cooling sedative, it suddenly allays pain and inflammation; as a strong styptick, it powerfully checks the bleeding of ruptured vessels, and other profuse evacuations. Its most active preparation is sugar of lead; but every preparation of this metal undoubtedly demands the utmost circumspection, and particularly when it is administered internally.

internally. By combining it with opium, to counteract its deleterious effect on the bowels, I have sometimes ventured to give it in certain desperate cases, and that with very evident advantage.† As lead enters the composition of a variety of applications, designed for external use, as lotions, eye-waters, ointments, plaisters, &c. the untoward symptoms which sometimes succeed, are totally unlooked for, and therefore generally referred to every cause but the right one. Among the popular applications of this class, *Goulard's* famous Extract of Saturn, and his vegeto-mineral water, seem to stand at the head of the list; and though perhaps inferior to an aqueous solution of the sugar of lead, are nevertheless far more fashionable remedies. Applications of this nature may, it is true, be used with tolerable safety where there is a whole skin, and its texture sufficiently entire to prevent absorption. But where it is soft and spongy, or the scarf skin stripped off, or ulcerated, the poison of course will be more liable to be absorbed into the system,

† Even thus guarded, the dose ought to be cautiously increased, and perhaps never exceed three or four grains a day. What are we to think then of certain English Dispensatories and Compendiums of Physick, (the daily companions of all our young practitioners) which gravely recommend it to be given from seven to nine, nay even to twelve grains and upwards a day! See *Quincy's* Dispensatory, *Shaw's* Practice of Physick, *Ball's* Practice of Physick, *Naval and Military Dispensatory*—in which last twenty grains are ordered for a single dose!

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and to produce its pernicious effects. Instances of this have been remarked by my friend *Dr. Percival*, and other accurate observers. To prevent the tender skin of infants from being excoriated, nurses seldom fail to sprinkle the parts plentifully with white lead. Hence perhaps the severe gripes and fatal convulsions which so often ensue, though generally attributed to other causes.

CHILDREN'S PLAYTHINGS are commonly painted with a composition of red or white lead; but how often do we see the smiling innocents suck within their lips those pernicious toys, while the unsuspecting parents look on with apparent satisfaction! The application of an ointment with litharge, or white lead, to nurses sore nipples, often proves fatal to sucking infants: twelve instances of this sort are recorded by *Sir George Baker* to have happened at Dartmouth.—Our common red wafers receive their colour from red lead. When these are accidentally picked up by tame birds, they soon prove fatal, which ought to be a caution to those inconsiderate persons who are fond of not only chewing, but swallowing them.

PAINTERS IN WATER-COLOURS are equally reprehensible for incautiously moistening their pencil with their lips, and frequently holding it in their
mouths

mouths a considerable time. Thus the saliva, repeatedly imbued with a slow poison, is insensibly swallowed from day to day, till at length the health becomes visibly impaired without the cause being suspected, unless the colick or palsy should supervene.†

COSMETICKS.—Were it permitted us to penetrate the secret recesses of the toilet, and to explore at leisure the nature of the mysterious articles which administer so conspicuously to artificial beauty, we should probably find that some of the most celebrated cosmeticks consist of preparations of lead, mercury, or bismuth.

Carmine, or harmless rouge, (as the ladies are pleased to term it) is a preparation of cochineal in nitrous acid, with some other ingredient which is kept a profound secret. This favourite composition, which gives the roseate bloom to their countenance, being prepared with a strong mineral acid, is not perhaps altogether so very innocent as they imagine: besides, its excessive dearness renders it an object of adulteration; and vermilion, (a preparation of mercury) though an humble imitation,

† A discovery we owe to the sagacity of my late excellent friend Dr. J. Fothergill.—See London Medical Inquiries, vol. v. obs. 37.

affords

affords a cheap and inviting ingredient to mix with it. To this, in its simple or combined state, they are generally beholden for their roses, while a calx of lead, or, what is equally pernicious, the magistery of bismuth, gives the last polish to the lily-whiteness which so dazzles our eyes.* It is thus our modern Hebes attempt to preserve a perpetual bloom, and to hold wrinkles and old age at defiance. But alas! these pernicious ingredients, like mercury, though only used externally, are liable to be imbibed at every pore, and thence convey a slow poison into the system, highly injurious to health; and, what may appear still more formidable, destructive to beauty! For dismal to relate! the cold cream, the pomade divine, or whatever specious titles such compositions may assume, at last betray their trust; and, instead of beauty, produce real deformity! The artificial roses soon fade, the angelick whiteness contracts a dingy brown,

* This poisonous composition is generally dignified by the pompous title of pearl powder, and sold as perfectly innocent. It has however proved fatal to some, and ruined the health of many others, without being even suspected. I am credibly informed, that those ladies who are in the habit of enamelling their faces, necks, and bosoms, with this white paint, generally fall early victims to their own indiscretion; but particularly so if they happen to undergo the small-pox, even by inoculation. Nor is this to be wondered at; the pustules being unable to penetrate outwardly through the enamelled skin, the virus recedes inwardly, and preys on the vital organs.

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when the mask falls off, and the spectre stands confessed!† Strange that British ladies, to whom nature has been so bountiful, should distrust their native charms, and have recourse to such wretched substitutes of art! Is it not truly mortifying that they should thus stoop to adorn, or rather disguise their persons, at the expence of their health!

But to quit so humiliating a subject. If what has been offered be not sufficient to put them on their guard, more would be ineffectual. However, before I conclude, there is one simple cosmetick I can venture with confidence to recommend to the ladies, as a perfectly safe, cheap, and efficacious substitute for all the pernicious tribe above-mentioned, and which may be freely used without any risk of detection,—a cosmetick which boasts the highest antiquity, and is perhaps the only true one acknowledged by Nature. It is not only innocent, but highly conducive to health. It clears the complexion far beyond the milk of roses; and when accompanied with regular hours and brisk exercise in the open air, diffuses over the countenance a more animated bloom than the finest rouge.—It is now needless to add, that this grand secret is no other than cold Spring Water!

† Particularly on exposure to the sun, a hot fire, or sulphureous vapours,

Method of detecting Lead by Chemical Test.

To point out a certain method of detecting the poison of lead, in whatever form it may be found lurking, next demands our consideration. This happily is practicable; but the principle on which it depends cannot be clearly understood but by those who are tolerably versed in chemistry. The fact, however, is highly interesting to the publick, and therefore ought to be universally known. In whatever substance, then, this insidious enemy may lie in ambush, whether in wine, cyder, foods, medicines, or cosmeticks, the following test, like the touch of *Itburiel's* spear, instantly brings the culprit to light.

Take of yellow orpiment in powder.....1 ounce,
 — of quick-lime fresh from the kiln.... 2 ounces,
 — of distilled water boiling hot.....20 ounces.

Let the whole stand twenty-four hours in a close vessel of glass or porcelain, stirring the mixture with a wooden spatula. Then carefully decant the clear liquor, and strain it into a bottle, which must be well secured and kept for use. Frequent exposure to air, destroys its transparency.

REMARKS.

1st. If a few drops of this liquor be put into a glass of wine or other suspected liquor, and no change

change of colour, or visible alteration ensue, be assured such liquor is free from lead, or metallick adulteration.

2dly. If the liquor contain the slightest impregnation of lead, as litharge, or sugar of lead, (the substances generally employed for the purposes of adulteration) on adding the test a precipitation will ensue of a *dusky brown sediment*.

3dly. If the suspected liquor be high coloured, it must be previously diluted with treble its quantity of distilled water, or the change will not be sufficiently perceptible: and care must be taken to add deliberately from three to six drops *only*, attentively marking the alteration. A larger quantity may re-dissolve the precipitate, and soon render it invisible.

4thly. As iron and other metals may produce a change of colour and precipitation, if any doubt should arise concerning the nature of the precipitate, let a quart of the suspected liquor be evaporated in a large crucible to an extract, and afterwards calcined in a red heat. When it is cold the metallick particles may be discovered in their proper form in the ashes.—Or the precipitate may be examined without a tedious evaporation, if it be

be placed on charcoal, and the flame of a candle be directed upon it with a blow-pipe, by which it may soon be reduced to its metallick state.

5thly. If to any medicine, perfume, or cosmetick in form of powder, liquid, or ointment, a few drops of this liquor be added, a brown colour will soon appear, if any impregnation of lead be present in the composition.

6thly. The vitriolick acid and saccharine acid may also be employed to precipitate lead from liquors, but the above test appears to me preferable to any thing of the kind yet discovered.

Preservative Method.

Smelters, plumbers, painters, and manufacturers of red and white lead, in carrying on their dangerous operations, often perceive a sweetish taste, attended with a slight nausea, or sense of faintness, evidently proceeding from the sugar of lead. But this approach to disease is too commonly neglected till health is completely ruined. Such persons should, previous to their going to work early in the morning, instead of drinking a pernicious dram, take a spoonful of castor oil, or oil of olives, and use fat oleaginous foods. For their further protection they

they ought to avail themselves of a free ventilation to carry off the noxious vapours, and also to breathe through mufflers composed of double cloth or flannel well dipped in an alkaline ley, and also be careful to throw off their dirty clothes the moment their work is over. By these precautions they probably might be in a great measure preserved from the poisonous fumes that daily surround them.— The like method of prevention is no less applicable to those who are occupied in other pernicious minerals, as grinders of verdigris, gilders in water-colours, workers in quicksilver, &c.

Method of Cure.

The treatment of the various stubborn disorders resulting from the poison of lead belongs not to the common people, but demands the early aid and attention of a judicious and experienced physician, who perfectly understands the chemical and medical properties of this mineral. Such a practitioner, however, is not always at hand; therefore to prevent improper management, or loss of time, I shall briefly sketch out the principal outlines of cure, which is all that can be attempted in the present essay. At first the poison generally exerts its virulence on the intestines under the form of colick, attended with severe pain, obstinate costiveness, and

and frequent retchings, which may be called the first stage. These symptoms are generally succeeded by a paralytick affection of the extremities, accompanied with numbness, loss of motion, and frequent pains through the limb affected. This may be considered as the second stage.

In the first stage, the chief intention is to restore a free passage through the bowels. But this is not to be attempted by strong emeticks, or rough purgatives, which, instead of answering the intention, serve but to exasperate the symptoms. The pain must first be allayed, and the spasm relaxed by a liberal use of opium and the warm bath, before purgatives can be retained, or administered with any prospect of success. A truce being thus obtained, evacuants will then have their desired effect. And if mild lenient catharticks, such as castor oil, calcined magnesia, Epsom salt, or phosphorated soda, should answer, it will be unnecessary to have recourse to the more draftick stimulating kind. Their operation will be greatly assisted by copious dilution with warm mutton broth, or new milk whey. As soon as the bowels are thoroughly emptied by this preparative course, they must be kept in a soluble state by such remedies as are gently laxative, and at the same time have a direct tendency to decompose the poison. Such a remedy is
liver

liver of sulphur, which possesses both these qualities in an eminent degree, and therefore promises to become one of the most powerful antidotes against this, and perhaps other metallick poisons. It is, however, too nauseous and unpalatable to be taken for any length of time in its natural state of hepar, though either of the ingredients may be taken separately without the least disgust. Therefore simple flowers of sulphur may be taken in any agreeable form; and if washed down with lime-water, or a weak alkaline lixivium, the result will be a hepar, and the effect the same.

When that remarkable transition of the disease from the bowels to the extremities, which so distinctly marks out the second stage, commences, the colick is immediately transformed into a palsy.

The indication now is to subdue the reliques of the poison which infest the nerves of motion, and also to restore the energy of those muscles whose action is impaired. Nothing bids so fair to answer this intention as warm mineral waters of the sulphureous and chalybeate kind, especially when they are used both internally and externally. Hence the surprizing efficacy of the BATH WATERS, which have long been found supereminently useful in this stage of the disease.

To those salubrious springs, as the *dernier resource*, invalids of this class continually repair from various parts of the globe, and particularly from the cyder counties.

Here, after the disease has baffled a variety of medicines, they often find a complete cure, and return home with joy and gratitude, leaving behind them their crutches as *votive tablets* in testimony of the superior efficacy of the water.

Here the liver of sulphur, in the subtilized form of hepatick air, together with a portion of iron in a highly attenuated state, are by nature admirably combined with the aqueous fluid, constituting a medicated compound, at once pleasing to the palate, congenial to the constitution, and hitherto inimitable by art.



ARTICLE XXXV.

On the POISON of COPPER.

[By the Same.]

Unde fames homini vetitorum tanta ciborum?
 Audetis vesci, genus ô mortale! quod oro,
 Ne facite; & monitis animos advertite nostris!

OVID. METAM. XV. 138.

Properties of COPPER, and its extensive Union with other Bodies.

COPPER, in consequence of its ductility and splendor, is well adapted to various purposes in metallurgy; but it is no less remarkable for its solubility. It is liable to be acted upon by almost all saline and metallick substances, and probably for this reason the ancient chemists have given it the whimsical name of *Venus*, considering it as a common prostitute to all other bodies. It readily dissolves not only in every acid, but also in alkalies both fixed and volatile, in neutral saline liquors, and even in vegetable oils and animal fats, in consequence of the latent acid which they contain.

Copper when rubbed with a warm hand yields an unpleasant odour, and, when applied to the tongue, a nauseous taste. Exposed to a moist air, it contracts a greenish rust; even pure water suffered

to stand long in copper vessels, contracts a coppery taste, and unwholesome quality.

It is very remarkable, that water becomes more strongly impregnated with the metal on standing in the cold, than if boiled in the vessel for a much longer space. The same is said to take place in regard to vegetable acids. Hence the confectioners venture to prepare the acid syrups even of orange and lemon juice in copper vessels. These acid preparations, according to *Dr. Lewis*, acquire no ill taste from the metal while kept in a boiling heat, whereas if kept cold in such vessels, they soon become impregnated with the disagreeable taste and pernicious qualities of the copper. But the mere taste is by no means a satisfactory test, because a very slight impregnation of copper may be so far disguised by the acid and sugar as to elude the taste, and yet prove injurious to the nervous system. Mineral acids are acknowledged to act more powerfully on this metal when aided by heat; and admitting that the action of vegetable acids is on the contrary weakened by heat, yet we have no proof that it is thereby wholly destroyed.

Preparations of Copper used in Medicine.

This metal with the vitriolick acid yields vitriolate copper, or blue vitriol;—with the vegetable acid,

acid, verdigris;—with volatile alkali, tincture of copper;—with sal ammoniack, ammoniacal copper. These are the principal preparations of copper that are now in use for medicinal purposes: they act as powerful tonicks, sedatives, and astringents, and become useful remedies, or virulent poisons, according as they are managed. Externally they are employed as escharoticks, for detarging foul ulcers, and disposing them to heal. Internally they are sometimes given in the hysterick, epileptic, intermittent, and other nervous diseases, but ought never to be administered without the utmost caution. Verdegris, being the most intractable of the whole class, has long been confined to external use, except for the purpose of expelling arsenick and other fatal poisons. It is generally rejected the moment it comes in contact with the stomach, and is perhaps one of the most instantaneous emeticks in nature; but as it operates with great vehemence, it perhaps ought not to be hazarded even in these cases, especially when the inflammation may be supposed to have already made a considerable progress.

In various Arts.

This and other preparations of copper are highly esteemed in the arts, for the beautiful blues and vivid greens which they communicate to various substances, and are therefore frequently employed in

painting in oil and water-colours, in colouring glass, and in enamelling. Even the ores of this metal exhibit a variety of exquisite colours, blue, red, green, yellow, variegated like the rainbow, or peacock's tail. The lapis lazuli, from which the precious blue pigment termed *ultramarine*, is prepared, is no other than an elegant ore of copper. To this the jasper and the sapphire also owe their beautiful tinge. Ores of this metal are found in most parts of the world; but when they happen to be mixed with iron, the copper cannot be separated to advantage by any method yet discovered; hence some rich copper-mines, on this account, remain unworked.

Copper is sometimes, though very rarely, present in waters under the form of vitriolated copper in solution. Such is the celebrated water of Wicklow in Ireland, which yields a considerable quantity of copper, by a very simple process. Iron bars are immersed in the water, and after some time are found covered with a rich coat of copper.* This instance

* A spring of this kind is also lately found near Berkeley in Somersetshire, which I lately had an opportunity of examining. The water imparts to polished iron a coppery appearance, has a nauseous styptick taste, and is powerfully emetick. The family, finding it unfit for use, have had recourse to a neighbouring spring, which, however, probably partakes in some degree of the same quality. Be this as it may, several of the family have at different times been attacked with severe epileptick fits, as they assured me on my visit to one of the brothers then labouring under that disease,

of chemical attraction has imposed on some persons so far as to be considered as an actual transmutation of iron into copper, but is in fact a mere precipitation.

In Combination with other Metals.

Copper readily unites with other metallick substances, and affords various compound metals.

Thus copper with about 1-4th part of zinc forms brass.

—— with 1-10th of tin—bell-metal

—— with 1-8th of arsenick—white copper.

It is moreover the basis of bronze, specula, Bath-metal, Prince's-metal, and all the yellow compounds prepared in imitation of gold. Even silver receives an alloy from copper, before it can acquire a proper degree of hardness for plate.

Brass is less disposed to contract rust than copper, and bell-metal than brass; white copper least of all; but the arsenick in its composition alone renders it totally unfit for culinary use. If acid liquors are suffered to stand a few hours in any vessel containing a mixture of copper, they acquire a bad taste, and consequently a slight impregnation of the metal. Nor are silver vessels wholly exempt from this inconvenience, especially such as are considerably alloyed with copper.

Effects

Effects of POISON of COPPER.

When this poison is accidentally received into the body, unless it be immediately expelled, it produces the most formidable symptoms, as enormous vomitings, profuse discharges of bile both upwards and downwards, inflammations and erosions of the stomach and bowels, delirium, convulsions, syncope, and death. Nay, even the handling of this poison in the form of verdigris, or a composition containing it, has in certain irritable habits been known to occasion very disagreeable effects.* The manufacturers of verdigris, and those who grind it for paint, or use it in oil or water-colours, seldom fail to experience its noxious influence on the organs of respiration or digestion.

“ I have known,” says an eminent Professor of chemistry, “ vehement vomitings and convulsions in children from the *Unguentum Ægyptiacum*, (whose basis is verdigris) injudiciously applied to ulcers in the mouth; † likewise a person, who accidentally

* See the extraordinary case of Mr. Butler of Moscow, as recorded by Dr. Mounsey. Among other symptoms, severe itching, and burning pungent pain darting through the limbs like electricity.

Phil. Transf. vol. 50, art. 2d. and Sequel, vol. 54, art. 2d.

† Newman's Chemical Works, vol. i, p. 98.

having

having swallowed a brass sleeve button, was seized with violent symptoms, and died in misery, no medicines giving relief."

Abuse of Copper Vessels.

It is extremely unpleasant to reflect on the dangers to which we are so often exposed by the use of copper vessels for preparing various foods. This consideration has indeed induced some discreet families to discard this dangerous metal from all culinary processes. But though verdigris is one of the most violent poisons in nature, yet the greater part of mankind, rather than abandon an old custom, are content to swallow a portion of this poison every day! Accordingly vessels of copper, brass, or bell-metal, are still permitted to supply their respective quota of this deleterious substance to imbue our several viands. Having, through long usage, obtained a quiet settlement amongst us, they now claim, as it were, a prescriptive right to assist at all culinary operations—a claim which we seem neither to have inclination or resolution to dispute: for, notwithstanding every remonstrance to the contrary, copper and its compounds continue to disgrace not only our kitchens, dairies, and confectionaries, but also the breweries, distilleries, laboratories, and even shops of the apothecaries.

caries. The very air of these places abounding with acid, oleaginous, and saline particles, penetrates and disposes them to dissolution, even before they are used. The mildest fluids, such as milk, whey, or even plain water, left to stand in open copper vessels, receive an impregnation of the metal, discoverable by the volatile alkali. But it is remarkable that the corrosion always begins at the surface, in contact with the air, and is distinguishable by leaving a greenish ring. Such is the power of the air in promoting the action of the menstruum. On this principle, perhaps, may be explained why acid vapours act more powerfully on lead and copper than the acids themselves, converting the former more speedily into ceruss, the latter into verdegris.

People generally imagine that the ill effects of copper are entirely prevented by its being tinned, and therefore without hesitation commit to such vessels acid soups, vinegar, lemon-juice, apple-sauce, greens, butter, and other articles equally exceptionable, where they are sometimes suffered to remain a considerable time without any suspicion of danger. But the tin which lines the copper is so extremely thin that it is soon abraded, or even penetrated by the verdigris, which insinuates itself through the pores of the metal, and at length be-
trays

trays itself by a green efflorescence on the surface. Add to this, the tin is generally alloyed with a considerable proportion of *lead*, besides an additional quantity contained in the solder.

Examples are indeed too frequent of fatal consequences from foods that had received a taint from copper vessels, whether from the food being of an acid nature so as to corrode or dissolve a portion of the metal, or from the vessel having contracted a soluble rust or verdigris, by exposure to the air, or being badly tinned. The affecting incident of this kind, which happened some years ago to several gentlemen at an entertainment at Salt-Hill, is still within our remembrance. Though it was then generally attributed to adulterated wine, it was at length brought to light by the confession of the cook, who acknowledged, just before her death, that it was wholly owing to the poison of copper, in consequence of her own carelessness, and which, through fear of punishment, she had been induced till then to conceal.

On dipping into some of our best systems of modern cookery, which have undergone several editions, I am sorry to find, amidst the numerous corrections and improvements, so much room still left for amendment, and so much serious cause for animadversion.

animadverſion. Nor is this to be wondered at. The culinary art depends almoſt entirely on chemical principles, and every profeſſed cook may in ſome meaſure be conſidered as a practical chemiſt; and the kitchen, the laboratory wherein are daily performed various chemical proceſſes highly important to health. The principles of chemiſtry therefore ought to be well underſtood by thoſe who practiſe cookery, and particularly by ſuch as undertake to inſtruct others in the art. But where ſhall we find cooks competent to the taſk? or even a ſingle book on the ſubject that does not betray the author's ignorance, not only of the chemical properties of the various ſubſtances, but alſo of the veſſels and apparatus employed. From this cauſe proceed many dangerous miſtakes and inaccuracies. Theſe from time to time are copied by ſucceeding writers, perhaps equally enlightened as their predecessors, and are thus tranſmitted through various new impreſſions. Hence we every where meet with error and inconfiſtency, blended with inſtruction; and theſe pervade all their works.

It is curious to remark, that in the introductory part of theſe complete Treatiſes on Modern Cookery, the reader is generally very gravely admoniſhed againſt the uſe of veſſels made of copper, braſs, and other dangerous materials—that vinegar and
falt

salt penetrate common earthen-ware, and therefore pickles ought to be kept in stone, or glass jars. But when arrived at the receipts for pickling and preserving acid fruits, what must be the gentle reader's astonishment to find those very vessels expressly recommended which so lately were absolutely condemned! Thus, in the process for pickling gerkins, or young cucumbers, "the best white-wine *vinegar*, in which they are to be pickled, is ordered to be boiled in a *bell-metal* pot." In a subsequent receipt "cucumbers are directed to be pickled in *pewter* dishes with *salt* interposed. Afterwards the vinegar to be poured from them into a copper saucepan with a little salt." It is added "they will then be fit to eat in two or three days!"

Lemon pickles are ordered to be done in an *earthen* dish—golden pippins in a *pewter* dish, with *vinegar*, &c.—"To pickle samphire; put it into a *brass* saucepan, throw in a handful of *salt*, and cover it with good *vinegar*, and set it over a slow fire."

Others, with less reserve, recommend *copper* coin to be put into each vessel in which these pickles are kept, because, say they, "it preserves their colour, and gives them a beautiful green."

From eating a quantity of fine pickled samphire thus imbued with copper, an amiable young lady was

was presently seized with dreadful convulsions, which soon put a period to her life. This melancholy case has been already communicated to the publick by my ingenious friend *Dr. Percival*.*

If our pickles must absolutely look green to please the eye at the expence of health, or even life, why should our fair authors, who preside over all culinary operations, and consequently over our health and lives, thus mince the matter? Why not steep the pickles at once in a strong solution of verdigris? This surely, on certain occasions, would be a capital improvement, as it would speedily impart to them a more elegant green, together with the entire virtue of the salutary ingredient. By thus rendering them "fit to eat" in two or three hours, instead of as many days, it would dispatch the business with more certainty and greater expedition.

After pickles we are presented with creams; therefore, to crown the banquet, I shall serve up a very curious one by way of desert.

Ratafia Cream.

Take six large laurel-leaves, boil them in a quart of thick cream, adding eggs, sugar, &c.

* See Med. Transf. of the Royal College, vol. iii.

Whether the subtile poison of the laurel, which this choice receipt exhibits in a very ample dose, is rendered wholly inert by boiling, and by being inviscated with the other ingredients, has not been determined. Or whether it may not still, though in a slight degree, exert a portion of its specifick power, similar to that of the celebrated laurel water, must be left to future experience. It comes in such a very doubtful form, that I can neither incline to try it myself, nor safely recommend the experiment to others.

The famous clotted cream of Devonshire being commonly prepared in *brass* vessels, bears also a very suspicious cast. It has sometimes been observed to betray a slight metallick taste, and to excite nausea and vomiting.

If from the kitchen we should dive into the cellar, we shall find that acid vapours are predominant, and that the brass cocks through which our wine, beer, cyder, and vinegar, are drawn, are generally discoloured with verdigris.

In these subterranean abodes, which are often very damp, the green rust is often suffered to accumulate till it overspreads the external surface of the metallick cock, and would also visibly pervade the

the

the internal orifice of the canal, were it not successively dissolved by the liquor, and washed off in the general current, as often as the cock is unturned.* That verdigris is soluble, in very considerable proportion, in all these liquors, and therefore capable of impregnating them with the poison of copper, is clearly proved by the following experiments:

	<i>Grains.</i>
1. Half a pint of rectified Spirit of Wine digested on half an ounce of Verdigris, (240 grains) dissolved	80
2. Same quantity of Malt Spirit	90
3. ————— French Brandy	150
4. ————— Water	100
5. ————— common Wine Vinegar	225
6. ————— Distilled Vinegar	230
7. ————— Wine, Beer, and Cyder, dissolved more than Water or Spirit, but less than either of the Vinegars.	

Should we once more revisit the shops, laboratories, and repositories of drugs, we should find that in these places, it requires no less care and attention

* The brass and copper cocks, now in use, being very unsafe, unless kept perfectly clean, which is perhaps impracticable, ought to be wholly discarded. Might not a mixture of tin and bismuth, a composition incapable of being affected by vegetable acids, be properly substituted in their place? or perhaps rather the improved wooden cocks, which would entirely prevent danger, or even suspicion?

to guard against the poison of copper, than that of lead. Here all the powerful solvents of copper are assembled; acids, alkalies, neutrals, and oleaginous bodies, stand in array, as it were, to attack this metal, and to disseminate its poison. Their very effluvia render all the copper vessels and utensils extremely prone to contract rust; hence medicines of the most innocent kind unexpectedly acquire a noxious quality. Thus in the distillation of simple waters, in a still of this metal, the last runnings, which are evidently acid, have frequently proved emetick. The same effect has been observed from distilled vinegar, which is indeed less to be wondered at; nor is it surprising that oxymels and acid syrups, prepared in copper vessels, should contract a similar quality. Various other acescent medicines being often evaporated in brass pans, or copper vessels badly tinned, are exposed to the like impregnation, and therefore extremely liable to suspicion, such as the lenitive electuary, Cassia electuary, rob of elder, and most of the vegetable extracts.

Even coral, burnt-hartshorn, crab's-claws, and other insipid testaceous bodies, however improbable it may appear, are not always exempt from this poison; for it has lately been discovered by the ingenious Mr. Blizard, that when these hard substances are triturated in a bell-metal mortar, if the powder be

closely examined, it will be found to contain particles of the metal separated by abrasion, visible to the naked eye, and further distinguishable by experiments with the volatile alkali.* Bell-metal contains a considerable portion of copper, therefore these mortars are not only liable to abrasion, but corrosion, by all the substances that are capable of acting upon copper.

Hence various absorbent, saline, and saponaceous bodies, whether reduced into the form of powders or pills in these mortars, may easily acquire an accidental impregnation of copper.

Brass mortars and utensils are equally subject to the same inconvenience.

Brass and copper scales speedily contract verdigris, from salt and groceries being weighed in them, as appears from the green efflorescence with which we generally see them discoloured.

Copper Roofs.

Of late the British copper mines have poured forth the ore in such abundance, that this metal begins to usurp the place of lead, and to extend its

* See Experiments and Observations on Copper and Bell-metal, 1786.

dominion from the cellar and kitchen to the upper stories, and even to the roofs of our houses; sheet copper being now the fashionable covering of various new buildings. Notwithstanding the lightness, cheapness, and elegance of this new covering, it has certain disadvantages, which seem to have been overlooked.

Being very liable to be corroded by air and watery moisture when thus exposed to the weather, the rain-water descending from such roofs and gutters cannot be very wholesome or eligible for internal use; yet where springs are scarce, the inhabitants are obliged to have recourse to rain-water for all domestick purposes. Nor will the painted coating, consisting of coal pitch, lately proposed for obviating this inconvenience, be likely to succeed, but rather to increase the evil, especially as it contains a manifest acid: and were white-lead paint to be used in its stead, the remedy still would be worse than the disease.

Copper, moreover, being a powerful conductor of electricity, might not such a wide-extended surface of insulated metal, aided by iron pallisadoes around the parapets, tend to invite the lightning in a severe thunder storm, and accumulate it, so as to shiver the whole building to atoms?

Breweries and Distilleries.

The immense coppers used in these and other great publick undertakings, being generally untinned, are peculiarly subject to corrosion, and therefore demand uncommon attention to cleanliness. In brewhouses, if any portion of wort (be it ever so small) is left to stand in the copper when cold, or longer than absolutely necessary, without being well cleaned out, it not only disposes the whole quantity of the subsequent liquor speedily to turn sour, but, what is worse, impregnates it with the poison of copper, incapable of being corrected by the succeeding fermentation.

The evil is greatly increased by a warm season; hence the frequent complaints of stale beer, particularly in the summer time, among many families. Such liquor within two or three weeks becomes acid, and unfit for use; and if the impregnation of copper is considerable, it proves emetick, and highly pernicious to those who drink it as daily beverage. On the other hand, those brewers who pay close attention to their vessels, and reward their servants for doing the same, prevent this unwholesome impregnation altogether, and have the additional satisfaction to find that their beer, instead of being returned on their hands as unsound, remains sweet and entire even in the hottest summers.

Dairies and Kitchens.

In dairies *milk* and *whey* are heated in large copper or brass cauldrons untinned; if these acescent fluids are left to stand long, a corrosion of the metal must necessarily ensue, or if they are set by without being carefully cleaned from time to time, they will certainly contract verdigris, being more subject to corrosion than lead.

Butter melted in copper sauce-pans, or those that are badly tinned, is peculiarly liable to acquire the same noxious impregnation, as appears from the nauseous taste of the metal, and the retchings and sickness which sometimes succeed the use of such pernicious sauce.

Esculent and acescent vegetables, such as spinage, cabbage, brocoli, and green pease, are generally esteemed at most tables in proportion to the degree of *greenness* which they assume. To heighten the colour, experienced housewives, not ignorant of the efficacy of copper, generally give the preference to such vessels, and to make sure work of it, on certain occasions, even direct that copper half-pence also should be added! Hence, perhaps, the austere metallick taste and nauseating quality which we sometimes, with regret and surprize, experience on partaking of these dainty inviting vegetables.

Tea.

The water in which tea is infused is commonly boiled in a copper kettle, and a remnant is often left to stand till the day following, and if the tin lining be worn off,* the water acquires an unpleasant taste, which is sometimes ascribed to the badness of the tea, when in fact, it is wholly owing to the vessel. After long use indeed, the kettle acquires a thick stony incrustation from the earthy particles deposited by the water, which more effectually guards the copper from corrosion; hence an old tea-kettle (*cæteris paribus*) is much safer than a new one. Tea, in its recent state, is said to be dried on hot plates of copper; hence, perhaps, its emetick quality, which however goes off before it arrives in this country. Whether the various nervous symptoms, generally attributed to that vegetable, may not sometimes proceed from a metallick impregnation, seems at least equivocal.

The abuse of copper vessels is by no means confined to cities, towns, and villages, but extends to

* So extremely thin is the tin in general, that even in the better sort of coating, it has been computed that half an ounce is made to cover 254 square inches, being only one grain of tin to a square inch, and in inferior sorts considerably less.

camp, fleets, and mercantile ships, where fewer accommodations, and less attention to cleanliness, may be naturally expected. Exclusive of this, copper vessels at sea are peculiarly liable to contract verdigris, from the marine acid with which the air is impregnated, to say nothing of the additional causes derived from the nature of the provisions, such as fat pork, and other salted meats, which are daily boiled in them.—“ I have myself known (says Mr. *Travis*) even a small ship’s boiler, through neglect of cleaning, become one-eighth of an inch thick of verdigris, which would sometimes separate in large flakes, and mix with the food; when it was no uncommon thing to have the whole crew seized with violent vomiting, &c. But the dose not being repeated long enough, they in general escaped the dreadful effects which attend the use of coppers in large men of war, where the friction is so great, especially in a rolling sea) that their coppers, though built as strong as possible, are obliged to be new set almost after every cruise.”

To this metallick poison, chiefly, he endeavours to trace that dreadful scourge the *Sea Scurvy*. For, adds he, “ the number of ships we send from Scarborough is about 200 sail, and the seamen about 3000. On board of these, *iron* pots are in general use, and we have no instance of any one having the
 symptoms

symptoms called *highly scorbutick*, except in some few of the larger ships, in which *coppers* are used.”*

I shall not here stop to enquire into the validity of this new theory of the scurvy, especially as other causes which prevail at sea are deemed fully adequate to the effect, as the saltness of provisions, impure air, together with bodily fatigue and watchings, without having recourse to this poison, which in general shews its effects more suddenly by attacking the bowels and nervous system.

However this may be, it is certain there have been innumerable instances of the pernicious consequences of eating foods dressed in copper vessels not sufficiently cleaned from this poisonous rust. Mr. *Ramsay*, and other navy surgeons, have observed many extraordinary cases of madness suddenly appearing among the crew, for which they could assign no other cause but the foulness of the coppers; but upon their remedying that fault, the disease presently stopped.†

The author of a tract, entitled “*Serious Reflections on the Dangers attending the Use of Copper Vessels*,” published at London in 1755, asserts that

* London Medical Inquiries, vol. ii. p. 13.

† Ibid. p. 150.

“ the

“the greater frequency of palsies, apoplexies, madness, and all the frightful train of nervous diseases which suddenly attack us without our being able to account for the cause, or which gradually weaken our faculties, are the poisonous effects of this pernicious metal taken into the body insensibly with our victuals, and thereby intermixed with the animal juices.”

From the numerous examples of these alarming maladies which have appeared since the above period, and *particularly of late*, we may conclude that the cause (whatever it may be) still subsists without the smallest diminution. If to the effects of this poison we add those of lead, and trace back their respective influence in cookery, pharmacy, and the arts; and reflect how often they may thus gain silent admission into our bodies in various foods, as well as medicines, we shall advance still nearer to the truth; and perhaps find sufficient cause for the above conjecture. If so, we shall see but too much reason to exclaim with the sons of the Prophets, (2 Kings iv. 40.)

“Death is in the Pot.”

But even admitting the mystery to be thus solved, and the real cause discovered, it still rests with our-
selv

selves to apply the remedy. Moved by considerations of this sort, the Senate of Sweden, about the year 1753, wisely prohibited copper vessels, and expressly ordained that none but such as were made of iron or tin should be used in their fleets and armies—an example highly worthy the imitation of the British Senate! The Royal College of London have at length done the same, by banishing copper vessels from all chemical and pharmaceutical operations at least, wherein their danger was apparent.*

It therefore only remains to be determined whether we mean to follow such bright examples, or to suffer this pernicious metal some time longer to disgrace our kitchens, and mingle its rust with our victuals; or in other words, whether we should not rather exert our authority, and resolve at once to extirpate the cause of the evil, than thus tamely submit to receive a daily portion of poison from our cooks.

Methods of detecting this Poison.

For the benefit of those persons who know the value of health, and wish to avoid the dangers that must daily await them while copper vessels continue to be employed in all culinary processes, I shall now

* See the new edition of their Pharmacopœia, in the year 1788.

add a few additional remarks on the principal chemical tests mentioned in the first essay, by way of illustration.

1st. The most exquisite test of the presence of copper is the *Volatile Alkali*, or *Spirit of Sal Ammoniac*. If ten or twelve drops of this spirit be added to any liquor impregnated with copper, it instantly exhibits a blue colour, in proportion to the quantity contained. This elegant experiment has been carried to an almost inconceivable degree of minuteness by the Honourable Mr. *Boyle*, so as to afford at once a striking example of the excellence of the test, and the extreme divisibility of this metal.

2^{dly}. Another method is by precipitation with iron. Thus if a piece of polished iron be immersed some time in any fluid wherein copper is held in solution by the intervention of an acid, the acid, having a stronger attraction to iron, lets go the copper to unite with it, and the copper is afterwards found adhering to its surface in its shining coppery form, as has been already mentioned.

3^{dly}. By *evaporation* of a large quantity of the liquor, and subsequent *calcination* and *reduction*, as proposed concerning lead.*

* Essay ii. p. 381.

Thus

Thus may acids, fermented liquors, and various suspected articles of diet, be easily put to the test.

Where clear pellucid liquors are to be examined, the *volatile alkali* alone is quite sufficient; but in all turbid or coloured mixtures, it will be sometimes requisite to have recourse to the several methods successively, by which, it is presumed, the poison cannot easily escape detection.

Indications of Cure.

Practical authors, among whom M. *Tiffot*, Dr. *Buchan*, and others, who have humanely condescended to instruct the common people concerning various diseases to which they are incident, seem to have been rather deficient concerning the treatment of metallick poisons. After the use of an emetick, they appear to lay the whole stress on copious dilution with milk, oil, or fat broths, which, though by no means improper, yet are too often found inadequate to the cure.

Milk, and oleaginous fluids, it must be observed, dissolve metallick salts with difficulty, and therefore are much inferior to tepid water, the common menstruum of all saline bodies, and the best diluent for washing them speedily out of the body. Oleaginous substances tend to mitigate the symptoms,
it

it is true, partly by evacuating, and partly by inve-
 loping the poison, but having no specifick power,
 entirely fail of subduing the remainder, which often
 lurks in ambush amidst the various folds of the in-
 terior coat of the stomach or bowels, and there
 continues to exert its mischievous effects.

As the consequences of mineral poisons are so
 sudden, and the symptoms so extremely rapid as
 frequently not to admit of calling in a physician, or
 even any other medical aid, I shall here attempt, in
 some sort, to supply the deficiency of those popular
 and truly respectable writers.

First Indication. Whenever this, or any other
 metallick poison has been inadvertently taken, the
 first indication is undoubtedly to expel it as speedily
 as possible by an emetick of very quick yet safe
 operation. For this purpose twenty grains of *White*
Vitriol may be dissolved in half a pint of warm wa-
 ter, and drank immediately, followed by very plen-
 tiful dilution with simple tepid water alone, till the
 whole of the poison is brought up, which may be
 known by an entire cessation of the symptoms.

With respect to the present poison, as a single
 grain of verdigris excites instant vomiting, it super-
 sedes the necessity of other emeticks, and this pro-
 pensity

penfity may be increased as long as may be convenient, by mere dilution. But where an hour or more has elapsed before the accident is discovered, a portion of the poifon has already entered the bowels, and cannot now be difcharged by vomiting, but requires peculiar management; which brings me to the fecond indication.

Second Indication. Which is, to correct the remaining poifon by proper antidotes, if any fuch be known, or to difcharge it downwards as fpeedily as poffible. Fortunately this may be generally accomplished where the nature of the poifon is previously known, and the remedy adminiftered before the internal parts are irreparably injured. This applies indeed principally to the poifons of the metallick clafs, which are much better underftood than thofe of the vegetable kind, and of courfe more eafily decompofed by chemical agents.

Thus if to a folution of verdigris, which is known to confift of copper combined with an acid, we prefent an alkali or abforbent earth, we know, from the laws of chemical attraction, that the acid prefers either of thefe bodies to copper, and will therefore deposit the metal in form of an inactive calx, now deftitute of the virulence it lately poffeffed from the acid. Therefore it may be very
advifeable,

adviseable, the moment this poison has been taken, to proceed as follows :

In about six quarts of tepid water dissolve half an ounce of any *alkaline* salt, as *salt of tartar*, *salt of wormwood*, or *pearl-ash*; or if these be not at hand, a solution of near double the quantity of common *wood-ashes* when strained through linen, may answer the end. Let a pint of this weak *alkaline ley* be drank every half hour, with a tea-spoonful of *calcined magnesia*, till the symptoms disappear. As a considerable part of the liquor will be rejected by vomiting, this copious dilution must be resolutely pursued till nearly the whole is taken, and the poison entirely decomposed, and washed out of the body.

A pint of the *alkaline ley* may also be administered clysterwise, especially if the pain should continue; and the *magnesia* must be repeated till it has operated briskly, so as to cleanse the stomach and bowels very effectually. For while the smallest particle of the poison remains unsubdued, the patient is not safe.

The *calcined magnesia* here seems greatly preferable to most other purgatives, particularly those of the acrid kind, which would be also highly improper,

proper, on account of their heating quality, and that for the following reasons :

1st. Because *magnesia* being perfectly mild and insipid, it sits easy on the stomach, while the others are constantly rejected.

2^{dly}. It operates in so gentle a way as to diminish the inflammatory disposition, which the others tend only to exasperate.

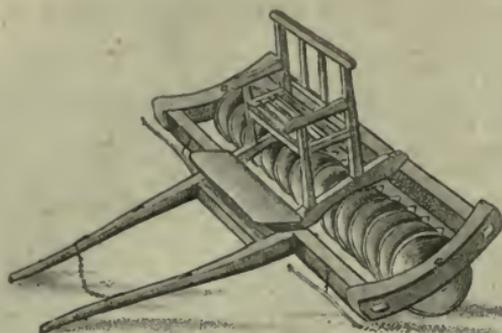
3^{dly}. As an absorbent earth, it corrects the acrimony of metallick poisons by decomposing them, and is perhaps the only cathartick that possesses this property.

After this treatment, should any relicks of the poison remain, which however is not very probable, the *liver of sulphur*, as recommended in the preceding essay, or a course of *Bath Waters*, accompanied by a milk and mucilaginous diet, will, it is presumed, seldom fail to compleat the cure.

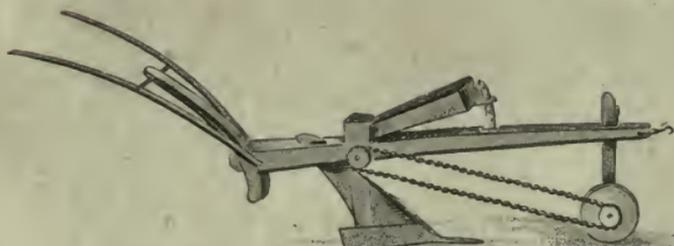
It may not be improper to observe that the above method is not confined to *verdigris*, or poison of *copper*, but is equally applicable to other mineral poisons, as those of *lead*, *glass of antimony*, *corrosive sublimate*, *cobalt*, and perhaps *arsenick* itself. This
last,



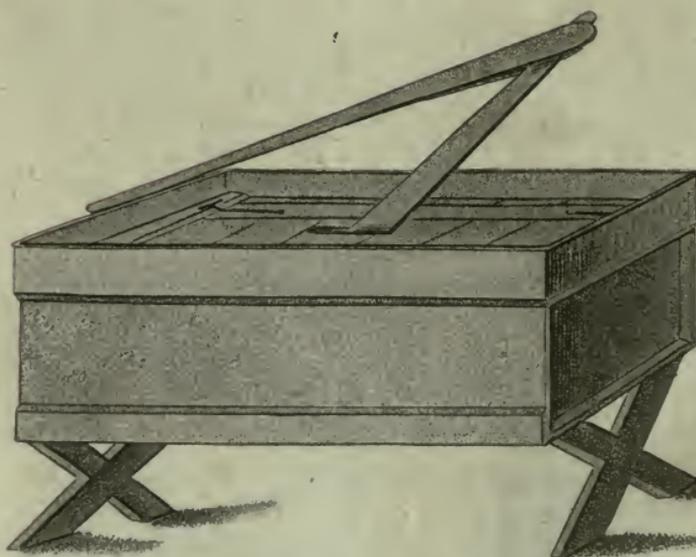
Plate. 2.



Drill Roller.



Murrell's Improv'd Single Drill.



Murrell's Patent Washing Machine.

last, however, is so refractory a substance, and so intractable to almost every method of treatment, that its component principles retain a degree of virulence even after they are disunited, and the metal decomposed. Hence it is matter of serious concern, that this most formidable poison begins to be administered as a medicine by almost every dabbler in physick!

It had long indeed been used as an empirical application against cancers, but of late it has been also given indiscriminately in some other diseases, nay even in common agues, wherein there could certainly be no just pretence for having recourse to so doubtful—so dangerous—so desperate a remedy!

ARTICLE XXXVI.

On the Mangel-Wurzel, and a new Drill-Roller.

[By Sir THOMAS BEEVOR, bart. to the Secretary.]

SIR,

I Have little to say in answer to your inquiry respecting the Mangel-Wurzel: the few plants of it which I cultivated last year afforded me no opportunity or ground whereby I could judge of their

effect upon the cattle which fed on them. I could therefore only try whether they would be eaten or rejected by cows, bullocks, and sheep; and whether, in case they were left in the ground, they would so well endure the vicissitudes of frost and thaw, through the winter, as to furnish the farmer with a certain and plentiful supply of food in the spring. With respect to the first object of my trials, the report I have to make is, that I found all my cows, bullocks, and sheep, would, after two or three days, feed as readily upon them as on turnips or any other food; but with regard to the latter object, I cannot say the result was so favourable as I could have wished, and did expect; for, notwithstanding the mildness of the weather through the whole of the last winter, and the different means I used for the preservation of the roots, by covering some of them lightly with earth; others with straw, and leaving others in the state in which they had grown; I did not find half of them sound or fit for use in the month of March. Now if this should have been the case with other crops, and they be not found able to resist the power of the frost, whilst standing in the field, I apprehend they will never answer the farmer's purpose as a winter food for cattle upon any large scale, since there could be very few men found who could spare time to pull up the product of from twenty to one, two, or three hundred

hundred acres of these roots before winter; and when pulled, I conceive there would be still fewer found who could contrive in what manner and place they might be put, so as to be secure from frost, and convenient for daily use; but perhaps, the evil I mention may not have generally existed, and may have been owing to some particular unheeded cause only; of this I wish to be informed, and mean again to attend to in this winter, as I hope other gentlemen will also do.

As I know nothing more likely to promote and produce a perfect agriculture than the knowledge and employment of such implements in cultivation as are well contrived, simple, and either originally or from their durability cheap, I have sent you the Model of an Iron Roller, which seems to answer in all those particulars. It has been lately invented, and is coming fast into use in this neighbourhood; it is contrived for the purpose of distributing the grain in regular rows, and at a proper depth; and has been found effectually productive of the principal benefits which have been derived from the operation of drill-ploughs, or the practice of dibbling and setting the corn by hand, with the great advantage of saving both time and expence; as, by the use of this simple machine, one man may sow and cover five or six acres of corn in one day, using

for the purpose three horses, as its weight is very considerable, and will require so many. It has been hitherto chiefly used on clover or other grass lays on the first ploughing, but may be as properly employed on land which has been three or four times ploughed. The view of the model will, I believe, give a full and clear idea of its operation, and make it unnecessary to add further to this account of it. Should the Gentlemen of the Society think otherwise, and that the object is worthy their attention, I shall readily convey to them every explanation they shall require.

I am, Sir, on this and every occasion, with much regard and esteem,

Your's, &c.

Hethel,

THOMAS BEEVOR.

Dec. 22, 1788.

The model above alluded to is delineated on a small scale, as per plate No. 2. The construction of it is so obvious, that bare inspection may suffice to shew its use. It is contrived for three horses to draw abreast, driven by a man elevated behind them. The length of the roller may be more or less, according to the choice of the owner: and the ribs of it may be also deep or shallow, so as to determine the depth of the drills, and the distances of the rows, by the same rule.

The

The common length is about eight feet; and if eight inch distances, for instance, should be thought most proper, then the roller would have twelve ribs. The common diameter is about twelve inches. It is almost unnecessary to remark, that the soil on which this implement can be used to greatest advantage must be a light one, the surface even, and well pulverized. The seed, after the roller has passed and prepared the drills, is to be sown broad-cast. It falls into the drills, almost wholly by the sowing; but that design is completed by a bush harrow, which is used across the drills to finish the business. After this the corn comes up in regular rows, as though drilled by a machine. Two horses may be deemed sufficient, on some soils.

ARTICLE XXXVII.

*On the Turnip-rooted Cabbage, Rooter Baga,
and Potatoes.*

[By the Same, to the Secretary.]

Hethel, Jan. 22, 1790.

SIR,

THE apprehension of increasing your trouble, by a frivolous and useless correspondence, has of late withheld me from writing to you; and though I have now ventured to do it, I am not without a fear, that the small morsels of experi-

mental information I am able to send you, will require your indulgence to accept of with any tolerable degree of complacency.

On the 30th of May 1788, I had four acres of turnip-rooted cabbages sown in the random or common method of turnip sowing, which, growing very thriftily, were hoed out the first time on the 1st of August following, and again a second time on the 16th. These plants endured the long and severe frost of the succeeding winter, without the least injury, though three-fourths of all the common turnips in this county were destroyed by it.

On the 21st of April 1789, I caused (in order to ascertain the quantity) twenty feet square of them to be taken up from three different parts of the field, which being weighed, I found the average produce to exceed, by six pounds, twenty-four tons and a half per acre; though at this time their tops had not sprouted above three inches in height; for these plants I was offered by some neighbours ten guineas per acre, but as my want of green food was great, I would not accept of it, or indeed of any greater sum for them.

If farmers would observe, they could not but learn, from their repeated experience, the very little
dependence

dependance which can be had on the supply of food for their cattle in the spring from a crop of common turnips, either after a severe and frosty winter, or after a very mild and warm one, (which last constantly causes so early a growth of their tops as to render both them and the roots of little or no worth) and they would then, I conceive, rarely fail to have such a proportion of the turnip-rooted cabbages growing on their lands, as would afford and ensure them a full and excellent provision for their cattle for about three or four weeks in the last part of the spring. A greater quantity of them I do not wish to recommend, as the consumption of them, particularly when drawn, and carried from off the land, is certainly attended with rather more trouble and expence than that of common turnips, especially if the soil be wet and heavy;—the best for them, and that on which mine grew, was a dry, sound, mixed soil, worth 16s. per acre, at the distance of seven miles from Norwich.

Though the very accurate, numerous, and valuable experiments of *Dr. Anderson* on Potatoes, may seem to have so fully instructed the publick in every particular necessary and useful respecting the culture of them, as to render any farther information or communication on that head unnecessary; yet as fresh and repeated experiments, carefully made,

and

and faithfully related, may chance to throw some additional light upon the subject, I have ventured to send you, in the annexed paper,* the result of one which was made here last summer; however, to avoid prolixity, I have left the corollaries to be drawn from it, to those gentlemen who may condescend to compare my account with the first three experiments related by the very able and ingenious Doctor, and printed in the last volume of the Society's valuable Papers.

I hope you will, before the receipt of this, have obtained from one or more of your numerous correspondents, some account of the use, produce, and value, of the *mowing cabbages*, as well as of the *Roota Baga*, of each of which I had last spring a small parcel of seed sent me, which was sown, and has produced several plants. Some of the mowing cabbages were cut down three times, and grew into head again so speedily, that had I had leisure to have attended to them, I doubt not but that the cuttings might have been repeated; but as there is never on my farm any want of fresh vegetable food for cattle in the summer, unless I can find them continue to vegetate in like manner during the winter (which mine have not done) or very early in the spring, I think they will not prove to me, or any one under the like circumstances, an object of much value.

* See the Table at the end of this article, p. 427.

The appearance of the Roota Baga plants is much more promising; their growth was quick, and their roots very much exceed in size all those of the turnip-rooted cabbages growing in the same field, and on precisely the same soil. They are firm, sweet, and particularly grateful to all cattle; unfortunately, they have been so much so to hares, pheasants, and wood-pigeons, as to have obliged me, in order to preserve some of the few plants I have raised, to transplant the chief of them into my garden, whereby I might secure a sufficiency of seed from them to sow in the ensuing season. Several of those in the field are very much eaten, whilst neither a turnip-rooted cabbage, a mowing cabbage, a common turnip, or a Scotch cabbage, all standing in the same field, are yet touched. They are, when dressed for the table, in the manner of other turnips, universally preferred to them; and if they should be found to endure the severity of the winter, retain their goodness late in the spring, and not decay and rot where bitten by the hares, &c. I shall not hesitate to prefer the cultivation of them to that of the turnip-rooted cabbage, or any other vegetable of the kind I have yet met with.

I have lately read a letter from Baron *Dimisdale* to that excellent farmer, and my most esteemed friend, Lord *Adam Gordon*, giving him an account
of

of a turnip called the *Hastings Turnip*, which he says a gentleman near Bath has cultivated in his garden, and of which the account is very flattering. If it be found to be sufficiently productive to serve as a crop for cattle, hardy enough to resist frost, and enduring late in the spring, I shall think myself greatly obliged if you would procure and send me a few seeds of it; and when the winter is passed, I will communicate to you what opinions I shall have formed of the value of the *Roota Baga* plants for the purposes of husbandry.

I am, Sir, yours, &c.

THOMAS BEEVOR.

*** The Society has not yet received any very particular or authenticated accounts of the value of the *Mowing Cabbage*; but for general information, as well as to gratify the curiosity of their valued correspondent Sir *Thomas Beevor*, they will be glad to receive from any quarter fresh accounts of those who have sown it.—The *Roota-Baga* is a plant from which great expectations are formed, both as a vegetable for the table, (in which respect Sir *Thomas's* opinion is generally agreed in) and as an article of food for cattle. Little doubt can be formed of its being hardier than the turnip;—and its greater sweetness and solidity must give it a preference in the esteem of many persons. We hope to be able in our next volume to give a fuller account of it.

April

April 30th, 1789, I planted Sixty Golden Dunn Potatoes, weighing together 13lb. 8oz. in five rows. The rows two feet asunder, soil strong and rich; but not dunged.

No. of Square Feet of Land.	No. of Potatoes.	Weight between the Sets Lb. Oz.	Distance between the Sets	Weight of Produce.			Measure, ditto			Weight per Acre.		
				St. Lb. Oz.	B. P. G.	Qt.	Ton. Cwt. St. Lb.	B. P. G.	Qt.	Ton. Cwt. St. Lb.	B. P. G.	Qt.
1	15	3 6	2 feet	9 10 0	1 3 0	2 3/4	44	1 4	8 13 5	2 1 1		
2	15	3 6	1 1/2 ditto	4 3 0	0 3 0	0 1 6	25	9 7	6 7 5	1 0 0		
3	60	1 11	2 ditto	3 5 0	0 2 1	1 7/8	15	4 5	4 3 6	3 1 0		
4	45	1 11	1 1/2 ditto	2 10 0	0 2 0	0 7/8	16	8 3	6 4 8	1 0 0		
5	15	3 6	1 ditto	10 1 14	1 3 1	0 1 pt.	29	19 6	2 8 8	1 2 0		
302	60.	13 8		30 1 14	5 1 0	3 1						

A Root of No. 1. produced 86 potatoes, varying from the size of a hen's to that of a swan's egg. The weight of which was, 1st. 5lb.—In the calculation of the weight, very small fractions are omitted.

** Nos. 1, 2, 5, were outside; 3, 4, inside rows.—A Bushel weighs 75lb.

ARTICLE XXXVIII.

*On Ploughs, and particularly the Rev. Mr. Cooke's
new Swing Plough.*

[By JAMES ADAM, esq; to the Secretary.]

SIR,

I WAS favoured with your circular letter of the 11th of August, and also with your very polite and obliging answer to mine, acknowledging at the same time the receipt of my book. I am much flattered to find from you, that it has met with the approbation of those Members of your Society who have done me the honour to peruse it; and as I have therein treated pretty fully of the form and mechanism of ploughs, as a matter extremely interesting to every agriculturist, I shall beg leave to trouble you with some of my latest experience and remarks on that subject, which I hope may become useful in leading towards farther improvement.

In the first section of my third essay, when speaking of ploughs, I have ventured to alledge, that, though the most common, they have ever appeared to me the least perfect of all the instruments of husbandry; and that I was of opinion, they were not yet well understood, either with respect to their construction

construction or mechanism. I have likewise observed in the same place, that the vast variety of ploughs over all Great-Britain and Ireland, was to me a convincing proof that none of them were perfectly good; for if any one of them had a decided superiority, it would have been pretty universally adopted, on similar soils.

This was the stile of language I used frequently to hold with my friend, the Reverend Mr. *Cooke*, the ingenious inventor of an inimitable drill-plough and horse-hoe. After many conversations of this kind, Mr. *Cooke* was induced to turn this subject in his mind, and some time after shewed me a model, which I have hinted at in the above-mentioned section of my book, as promising well. Since that time Mr. *Cooke* has pursued his idea, and, in my opinion, with great success. In short, he got some bodies of ploughs made of cast-iron, consisting of a mould-board regularly twisted, with the land side of the plough, and a plug for fixing on the share, all in one piece. This combination of the parts, which so essentially affect the operation of the plough, prevents the possibility of their undergoing any alteration from the unskilfulness of country ploughwrights, who have only to add the common wood-work to these cast-iron bodies.

Mr.

Mr. *Cooke* had one of them fitted up at London as a swing-plough, with a share of wrought iron, a coulter, and the necessary wood-work. This he tried in a loamy soil, and it answered perfectly well, but this did not satisfy me; I therefore requested him to come and spend a few days with me in the country, and take along with us two of his iron casts, in order to have them fitted up, and make trial of them in some of the strongest soil in England, and in many places mixed with flints and pebbles. This he cheerfully complied with;—we accordingly put our plan in execution, and for a first essay, I think I may add, that we met with most extraordinary success. I was so much pleased with my two swing-ploughs of this new form and construction, that I have ploughed with them ever since, and I will venture to say it is the best ploughing ever performed on so strong a soil.

I believe, Sir, your Society will admit that this plough has some peculiar excellencies, when I tell you that it requires but three horses instead of four, which I have always used on this land, which is not only strong but hilly; and I am confident two horses would be quite sufficient in this plough, were the land level and loamy: and besides, that it turns a clean and square furrow of seven or eight inches deep; that it lays it over completely, and that it breaks and shivers it in the action of turning.

When we find so many good qualities in a swing-plough, which is at the same time so simple in its construction and tackle, would it not be absurd ever to employ a wheel-plough, with four horses, to do the work which can be done by the swing with two or three at most? and yet so powerful is custom, or fashion, or prejudice, that I see every farmer round me dragging a heavy Hertfordshire wheel-plough over his lands, which in many soils does no more than scratch them. I am sure I do not exaggerate, when I say that many farmers in this neighbourhood do not turn a furrow of above three inches deep. But besides this, our clumsy wheel-ploughs are all made with straight mould-boards, which do not turn the flag, unless the ploughman lays them over so much on the land side edge, that the tail of the mould-board sweeps along the under side of the turning turf, and helps to lay it over. This position of the plough is attended with one very bad consequence, which is, that it raises the fin of the share out of the level; this makes it cut the bottom of the furrow obliquely, and the turf or flag thus raised is not square or parallel, but triangular, leaving the soil when ploughed of unequal depths.

This I call a very great defect in our wheel-ploughs, but this is not the only one; for the most
 skilful

skilful ploughman, in using that implement, must run it over a certain space before he can lay sufficient hold of the soil to turn up a tolerable furrow, and at the further end of the ridge he repeats the same defect, and a certain space is blinked, in gradually raising the share out of the soil; and thus, both ends of the ridges are worse ploughed than the rest of the land, which I call another great defect. But what is worst of all, is, that in wettish or doughy land, the wheels of the plough are so clogged with the tough soil, that it is impossible to make them move round, and thus the ploughing is stopped, however pressing the season.

Is it not then astonishing, that with all these capital defects, the wheel-plough should yet remain the favourite implement in this and other counties, where agriculture is so well understood; and that so light and so efficient an implement as the swing-plough should be so much neglected! I will venture to assert, that wherever there is a fair comparison made between the operation of the best wheel-plough and the swing-plough invented by Mr. *Cooke*, that the latter will be greatly preferred.

I do not however mean to alledge that the swing-plough is altogether faultless; there is no implement I ever saw, without some defect, and that of the

the

the swing-plough is, its being liable to be thrown out of its work by some large flint or pebble, or by a slip of the ploughman's foot, who, leaning his weight on the handles, raises the share out of the ground; but this defect is soon remedied by drawing back the plough to where it first began to lose its depth, and re-entering the furrow on its former level.

On the other hand, is not this defect more than compensated by the lightness of the draught, the simplicity of the tackle, the immediate depth of furrow, its being well turned over, clean, square and deep, and its equality to the extremity of the ridge? When I mention a deep furrow, I mean one of seven or eight inches in a strong soil, which I have never yet seen done by any of our wheel-ploughs.

From whence the ridiculous predilection in favour of these ploughs should arise, I am at a loss to determine, unless it be, as before observed, from custom, or fashion, or prejudice, or some such reason as frivolous and unsatisfactory. I, who have tried both, and have given to each a most impartial observation, must fairly decide in favour of the swing, except in very particular cases, such as breaking up an old ley or very strong soil, rendered hard by a long continuance of drought, or for stir-

ring to some uncommon depth, such as eighteen inches, which Mr. *Arbutnot* did with a wheel-plough of his own construction, described in my first volume, page 214, where I have also given a plate of it.

Before I conclude, I must observe, that the fin of the share of Mr. *Cooke's* swing-plough is very nearly as wide as the heel of the plough, by which means the bottom of the furrow is as completely cut by it as the land side is by the coulter; thus nothing is left to be done by the breast of the plough and mould-board, but to raise the flag gradually, and lay it over completely.

I think it likewise necessary to mention, that the Suffolk cat-head and copse (as described in the above-quoted essay, where a plate is given of them) are what I use for regulating the width and depth of my furrow. A small alteration in the length of the ridger over the thill-horse also sets the plough more or less rank; but it must be observed, that it should never be taken up too short, for that creates a very hurtful angle in the line of traction. Neither must I omit to mention, that the rising flag sweeps along my cast-iron mould-board* so glibly,

* A cast-iron mould-board is not a correct expression, but we say, as incorrectly, a silver candlestick, a glass inkhorn, &c. preserving the names of the materials of which these utensils were originally formed.

touching

touching every part as it passes, that it has polished it like bright steel.

Some old farmers in this neighbourhood not over-fond of novelties, and even the ploughwright who works for me, confess that they never saw so much execution done by so small and so light an implement.

I have been the more diffuse on this subject, because I see from the fourth volume of your transactions that the improvement of ploughs has been an object with your Society. I am not at all qualified to judge of the ploughs produced to the Society, having neither seen them nor the work they performed; but I hope the Society will excuse my making some few remarks upon those trials as they are there related. In the first place, I should imagine that the trials of wheel-ploughs and of swing-ploughs, in order to be correct, should be made separately, because they are intended for very different purposes, and therefore what is a task for a wheel-plough, is not a task for a swing, and *vice versa*.

In the second place, the task prescribed by your committee was a furrow of four inches deep only, which does not seem to me a sufficient trial of a real

effective implement, armed with two coulter, and drawn by six oxen. I confess, I should have supposed that no furrow under eight inches was adequate to such a formidable apparatus, let the soil be what it would. The execution of the work performed by this plough was surely abundantly rapid, and I have no doubt of its being well done, as it was approved of by the committee; but I must still contend that the task was not suitable, or, in other words, this plough was improperly employed upon a four-inch furrow. However, this plough, if tried, would perhaps have performed its part equally well on a much deeper furrow, and therefore it would be highly gratifying to all lovers of agriculture to see a plate and description* of it in your next publication; and might I so far presume, I would point out my method of describing Mr. *Arbutnot's* wheel-plough (vol. i.) as being not only accurate, but because it enables any person to have one made from it, all the dimensions being marked.

With regard to Mr. *Thomas's* light swing-plough, it seems to me extremely singular, that when drawn by four small oxen it could not perform a task apparently so easy as a four-inch furrow, without the

* A description without a plate would be somewhat difficult to render full and plain; this plough is now pretty well known, but perhaps in a future volume a plate of this and some other sorts may be given.

additional

additional aid of a horse. This would almost lead me to suspect some error in the mechanism of his plough.

The single wheel under the beam of farmer *Sully's* plough, I should apprehend would destroy its utility as a swing, without making it a good wheel-plough. The wheel, I am sure, must render this plough very useless on wet tough land, as I have before remarked.

I am, with great regard, Sir,

Your most obedient humble servant,

JAMES ADAM.

Shenley-Lodge, Herts,

Nov. 13, 1789.

[The Society is much obliged to Mr. ADAM for this letter, particularly as it describes a new plough which promises to become of publick utility. With regard to Mr. ADAM's strictures on the ploughs used at the last publick trial for the premiums of this Society; it is presumed that had he been present, and a witness of the uncommon strength of the soil, under an old ley, and rendered still harder by frost, he would have thought the task no unequal one for six oxen drawing a double-coultured plough only on a four-inch furrow. Nor will the difficulty with which a light single plough could be drawn by four oxen, without the aid of a horse, be considered as a trivial argument in favour of the double plough.]

ARTICLE XXXIX.

On various Subjects.

[In a Letter to the SECRETARY.]

L——, *South-Wales*, Nov. 27, 1789.

SIR,

I AM favoured with your's, and shall always be glad to promote the patriotick views of your Society, by communicating my observations on Agriculture, but as I have not time to correct what I write, I beg that my name may not be made publick.*

I very much approve of substituting horse-hoeing crops, especially instead of summer fallows, which are tedious and expensive. Our ablest and best farmers have for the last fifty years been accustomed to lay on their summer fallows for wheat from four

* After such a request the Committee cannot feel themselves at liberty to publish the name of this practical and intelligent gentleman; but as the letter is not anonymous in itself, and the style and good sense of the composition are striking, no apology to our readers can be necessary, for departing from a general rule in suppressing a signature. We wish an increased number of such correspondents on any terms, and Agriculture many more such friends.

to five hundred bushels of lime per acre; which with four or five ploughings and harrowing, and the rent, seed, and taxes, cost them from five to seven pounds per acre; and they were subject to the like expence the second summer before they obtained any benefit from their first crops of wheat, which distressed them, and delayed the payment of their rents, as most farmers are ambitious to rent farms too large for their capitals. After wheat they usually sowed barley and clover; and then wheat, and barley, and sometimes oats; which last crop did much harm to the land, and they were obliged to let it rest five or six years to their loss. Having large estates under my care, and farmed for some years, I am endeavouring to improve them by advice and example, as well as by restrictive covenants in their leases; and I have the pleasure to think that my endeavours, with those of some other gentlemen in this county, and the rewards offered by our Society (the Glamorganshire) productive of much good.

As the principal object of summer fallows is to clean the land, I think turnips, rape, kale, &c. in winter; and potatoes, mangel-wurzel, beans, &c. in summer, will fully answer that end, and keep the land in good heart, with occasional dressings.

I have

I have successfully followed the advice of Sir Thomas Beavor in raising turnip-rooted cabbage in drills, and horse-hoeing the intervals, eating them off with sheep after my turnips, and immediately sowing buckwheat (hardly known before here) and afterwards wheat.

In other fields I have planted potatoes, well ploughed the intervals, drawn them with the plough at Michaelmas, and immediately sown wheat.

Beans answer as a fallow crop in the same way, and I have no doubt but the mangel-wurzel will answer the same intention.

After sending small parcels of the seed you sent me last March, to as many of our Members as have farms, I sowed the rest very thin in drills two feet asunder (which should have been three feet;) we had very little rain in April, May, or June, and many died; about Midsummer I thinned them to about a foot asunder, and made other parallel rows in the same field, and when the rain came they grew amazingly, and I ploughed the intervals as I usually do to potatoes and beans. In August I drew some of the collateral leaves for my cattle and hogs, but the necessary attention to the hay and corn harvest (which this year came very inconveniently together) prevented

prevented much attention to this crop; which I have lately drawn and housed, and I have sown wheat in the ground.—Many of the plants weighed from fifteen to twenty pounds; and if they keep well in the house three or four months, and nourish my horses, cattle, sheep, and hogs (or any of them) well, I shall esteem them very highly, and think them a very valuable acquisition in agriculture. I observed no material difference between those transplanted and not.

My land is not deep, and light enough for carrots and parsnips, which I think are not so easily cultivated as the mangel-wurzel, and will not produce such heavy crops.

I fattened oxen with raw sliced potatoes and hay last spring, and I think it is much better for a farmer to plant them in his fallows, though he should make but ten or twelve shillings per ton in feeding his horses, cattle and hogs, in winter, than to keep his naked fallows often turned and cleaned from weeds, and to let the whole expence fall on the wheat crop, which it will not always repay. Besides, the potatoes will yield three times as much near great cities and towns; but I draw no general principles from local advantages. In many situations it is very expensive to carry corn to mill or market,

market, but if the farmer can raise crops that will pay to feed his live stock at home, and increase his manure, those creatures will walk a long way to fair or market at a very little expence.

I think it is clearly a good practice to raise *culmiferous* and *leguminous* crops *alternately*; in this county lime is so cheap, that I occasionally use lime for the former, and dung for the latter crops; by which the land may be kept clean and in good heart many years, without the expence and loss of time in making summer fallows. I find my sheep more averse to eat sliced potatoes than any of the other animals I have named.

Tythe in kind has cramped and will always obstruct great improvements in agriculture; let some fair commutation be settled, and a cheaper way of obtaining inclosing bills, and a more permanent possession secured to the farmer, and I am convinced the improvements in agriculture will in a few years be very great.

I think it would be useful if your correspondents would say how often, and upon how large a scale, they have practised what they recommend, and with what success.

It

It is unreasonable that the most industrious farmer, who lays most money out of his pocket to buy lime and other manure for his land, shall, before he is repaid his expences, render one-tenth of his crop, which often turns the balance against him; whilst his idle neighbour, having but poor crops at a very little expence, pays the church less than half as much for a farm of equal value. I know that the tenth of a good crop is often the whole of, and sometimes more than the farmer's gain; therefore tythe in kind prevents the cultivation of thousands of acres, to the great loss of the community. The arguments against tythe in kind are so many and so strong, as well on account of national and private injury, as the antipathy and law-suits created between the clergy and laity, that nothing but infatuation can prevent a reform so much wanted, and wished for by all candid well-informed men. I have beneficial tythe leases, and therefore am writing against my own interest. Most people that have written on this subject want patriotism, candour, or sufficient information. This mode of paying the clergy might be the best before the use of money, but it certainly is the worst now.

Respecting Mr. *Vagg's* method of night-rolling, my men could not see any slugs on the ground or the roller after rolling two or three nights; and
when

when my turnips were four or five inches above the ground, many of the leaves appeared yellow, and on examination, a small long worm was found eating the root, which worm the roller would not destroy. I wish to know if many farmers have succeeded by night-rolling.

I generally drill my turnips, and shall in future provide rape, kale, or other plants, to fill up the rows where the turnips miscarry, so that the ground may be full, and my sheep may not be disappointed.

ARTICLE XL.

On Timber Trees.

[In a Letter to the SECRETARY.]

THE wish you expressed that I would send the account of the growth of various kinds of timber trees that have fallen under my notice, planted at different periods and under different circumstances, has induced me to forward the following facts and observations; and though I am sensible they are not abstractedly of much value, yet repeated accounts of a similar nature accurately made, and properly compared together, would probably

bably exhibit the subject in new lights, and enable your Society to direct the future planter to those exertions that may prove eventually most profitable to his estate, and most beneficial to the publick, which is the ultimate object of your patriotick association.

No. 1. Red or black poplars planted on meadows near Norwich on a good warm moist soil, from 1746 to 1748, in stands without roots, measure at this time (1790) at about five feet from the ground, six feet to six feet and a half in circumference, and are from forty to fifty feet high.

No. 2. The same kind planted in the same place and manner, in 1765, 66, and 67, measure four feet to five feet and an inch round, and are nearly equally high as the foregoing.

No. 3. A peculiar kind of abele tree planted at Seething in the year 1760, in stands without roots ten or eleven feet long, on a bank about thirteen feet broad, with water on each side, the bank firm land, measure, at about five feet from the ground, five feet to five feet nine inches round, and are tall flourishing trees.

No. 4. Ashes planted out in 1758 and 59, eight to nine feet high, on good meadow ground, are now from three feet eight inches to four feet round.

No. 5.

No. 5. Oaks transplanted three or four feet high from a nursery in 1764 into a good lightish soil, dug two spades deep, well cleaned, the trees planted pretty thick, are become very tall, and measure at this time from eighteen inches to two feet round, at about five feet from the ground.

No. 6. Some of the same oaks left in the original nursery, are from eighteen inches to two feet four inches in circumference.

No. 7. Some of the same, planted in an upland pasture (the soil clay) in 1769, when ten or eleven feet high, are now from eighteen inches to two feet round.

No. 8. A particular timber oak measured in
 1768—seven feet eight inches.
 1771—eight feet.
 1790—ten feet three inches.

No. 9. I have a small piece of ground little more than half an acre, and worth about eight shillings a year planted in 1764 with various kinds of firs, intermixed with young oaks. The firs have been felled by degrees for rails, joists, spars, and other uses, to the value of twenty-five pounds, and have left a grove of healthy and promising oaks.

On these facts I shall take the liberty of making a few observations. With regard to the first and second articles, the poplars, the advantages attending their rapid growth require no comment: but I may just remark, the soil as already described was particularly adapted to them, and that these plants are very apt to fail, where there are cold springs, or the lower soil is gravel.

The third, the abele tree, exhibits a remarkable instance of rapid growth. An old tenant of mine procured the original tree, I know not from whence, under the name of *Dutch Beech*; finding the cuttings flourish uncommonly, I have planted them in a variety of soil and situation, and at present I have not found any in which it does not exceed every kind of tree in its first stages. I have one particular spot where the soil is barren ooze, raised by an addition of the same soil thrown out to form a piece of water: I planted it with various kinds of trees; they all died or remained without growth, except some small cuttings of this kind, which being intermixed, flourished as usual, and promise to become large trees.

I have planted it on ground where cold springs rise, and where the red or black poplar, after arriving at some size, died; they flourish there also with
great

great vigour. A friend of mine has planted them on high and dry ground, where they have also exceeded every kind of tree planted with them; the wood has all the apparent properties of this species, and promises to be excellent for turners, and other uses. Its appearance is by far the most beautiful of any of the poplar, abele, or aspen kind, that has fallen within my observation; the bark is of a greenish yellow colour, delicately smooth, the branches grow in a very pleasing and compact form; the colour of the leaf in spring is a beautiful sage green, growing darker as the summer approaches, the under side becomes then of a light colour, the upper of a darkish green, forming a medium between the aspen and *populus alba*, or abele tree.

I have been thus particular in my description of this tree, not knowing but it may be found in other places, and that some of your correspondents may be induced to propagate it. Its beautiful appearance and rapid growth point it out to those gentlemen who plant for ornament; and as no tree that I have seen is so cheaply propagated, is less delicate as to soil, or is sooner productive, it is consequently a primary object to the man who plants for profit.

On No. 5, 6, and 7, I have to remark, that the transplanted oaks, though for a few years they
suffered

suffered in the removal, recovered themselves by degrees, and discover now, after 20 to 24 years, little difference from those left in their native soil:—as to the tree in No. 6 measuring 2 feet 4 inches, it was always larger than the others, and therefore no rule for the general average;—even those transplanted at 10 or 11 feet high, are scarce at all inferior to the rest.

The growth of the oaks, by the facts recited, appear to bear no comparison to that of other trees; the first remark that consequently strikes every observer is, that this is the least profitable tree that can be planted; and, if a man looks for the produce of the first 25 or 30 years only, this is undoubtedly the case. First impressions are difficult to eradicate, yet I wish to see as many facts as possible collected upon this subject, to ascertain the point indubitably. I think it will appear that the instances I have stated of the rapid growth of poplars, abeles, and ashes, are as great as any that have been produced; nevertheless, what I have recited, taken altogether, tend to enforce upon my mind the doctrine of the superiority of oak planting, in point of profit;—its beauty and utility will be universally allowed me.

The facts adduced prove, that for the first 25 or 30 years, poplars, abeles, and ashes, exceed the oak

In growth in the proportion of at least two to one. I wish some of your ingenious correspondents could furnish a register for the succeeding 40 to 60 years: but as the durability of human life is too little for such records, and the spirit of observation is seldom transmitted from father to son through many generations, we must be content with reasoning from detached facts; and this leads me to No. 8.— I found in my father's papers the two first admeasurements of this tree, and I have within a few days taken that of the present date; by this it will appear it has increased rapidly and uniformly; and I need not remark that, as it continues to increase at the rate of somewhat more than $1\frac{1}{3}$ inch yearly, it adds every year a greater and greater quantity of timber, in geometrical progression; and admitting that in 1768 it contained 110 feet of timber, in 1790 it contains 200 feet. I do not know that I am accurate as to the real contents, but the relative proportions are correct, which is all that applies to the present argument. The increase, which is 90 feet of timber, is wonderful for 22 years, and not to be equalled, as I conceive, by any of the other kinds, at any period of their growth; the difference between the poplars of No. 1 and 2 in 20 years was, in the same mode of estimating them, only 39 feet of timber each. But if, as in fact No. 9 in addition to this advantage, a crop can be obtained that will
 amply

amply pay the rent and charges of the land for the first 20 or 30 years, and at the same time tend to rear and nurse up the oaks intended for the future grove, we must consider our plantation as only then commencing its career, and charge it with no expences till that period arrives. We shall then find, that if the mind balanced upon the subject, under the head of the last consideration, the present one will preponderate the scale in favour of our doctrine: and this reasoning applies to no other trees we have mentioned, for poplars will not thrive on such soils; —the drip of ashes is allowed to be injurious, and these, as well as the abeles, would overtop and spoil the firs; not to add, that as all these derive their nourishment from lateral roots, they would impede if not prevent the growth of firs; whilst in oaks, experience shews that their supply is derived from a deeper soil, or they are furnished with different particles of nutrition; there seems too something congenial in their nature, and in their configuration there is an adaption to each other.

When I consider all the circumstances, I am inclined to draw this conclusion, that if a register for 100 to 150 years could be procured, of ground applied to the growth of oak timber, and the like quantity applied to the growth of any other kind, the former would prove at least equally productive

in quantity, notwithstanding the superior increase of the soft woods for the first 20 or 30 years, with this additional advantage, that the timber is of one-third greater value.

My object in this memoir is not to decide dogmatically, but to promote a more accurate enquiry on the subject. The planters of oak seem hitherto to have exerted themselves, as discharging a kind of duty to their country, in propagating this important and indeed necessary timber; but as interest is a motive more prevalent than patriotism, if it shall be made appear, as I think it will, that it is to the advantage of gentlemen to plant this kind of tree in preference to all others, upon soils suitable to it, we may hope to see the practice become general, and thus the estates of individuals benefited, as well as the national interest in this very important article secured to posterity.

[The foregoing ingenious and valuable article is the communication of a Norfolk gentleman, well known and universally respected; the insertion of whose name would have done honour to this Society: In compliance with his particular wishes and diffidence, that name is suppressed. But it remains with the Secretary, and may be known by any gentleman who may have a motive for enquiry.]

ARTICLE XL.

On the Turnip Cabbage.

[To the Secretary.]

SIR,

I Send you herewith a plant of a species of vegetable, I believe, as yet but little known in England. I received the seed last year, under the name of Turnip Cabbage, said to be brought by Mr. *Hastings* from the Cape of Good Hope. It is a very hardy plant, enduring the winter at least as well if not better than brocoli. I have found it a most valuable acquisition to the kitchen garden; and it might probably be introduced with advantage by the farmer as an article of fodder for his stock. I shall take a future opportunity to send you a small parcel of seed, which I have saved from a plant of last year's sowing, and likewise some particulars respecting the mode and seasons of cultivating it.

I am, Sir,

Your humble servant,

THO. BROUGHTON.

TWERTON,

Sept. 23, 1788.

ARTICLE XLI.

On the Turnip-Cabbage.

[By the Same.]

SIR,

IN reply to your queries respecting the turnip-cabbage, I must observe, that as the most essential part of my experiments on that plant, viz. its value in field culture, remains yet to be made; and as I purpose (should it succeed in that respect) to give the publick a separate and minute account of it; I can at present state only a few general facts respecting it; and this I shall do as nearly in the order of your queries as possible.

I have not been able to ascertain in what country it was first produced, but am informed that it is very common in Holland, and at the Cape of Good-Hope. It has certainly been known in Britain many years, though not generally. *Miller* does not notice it, but it is particularly mentioned in the list of esculent plants at the end of the octavo edition of "Every Man his own Gardener," by *Mawe* and others, published in 1776; and it is there especially distinguished from the turnip-rooted cabbage, to which it bears little or no resemblance. It bears a much greater resemblance to the cab-
bage

bage tribe than to the turnip, whereas the Roota-Baga you mention (from the slight acquaintance I have with it) appears to be more nearly allied to the turnip.

The best season for sowing for the garden, appears to me to be the end of May, or beginning of June. Though sown ever so early, I never saw one run the same summer; indeed I have sown in August at the cauliflower season, and the greater part have stood over the following summer, and not run till the second spring, which is certainly a very uncommon property.

With respect to the management of the plants, they require nearly the same treatment as brocoli, in regard to transplanting, distance, &c. They are usually most esteemed when young, and about the size of a moderate garden turnip; those sown in June will continue good all the winter. The bulb must be stripped very clean of its thick fibrous rind; after which it may be treated as a turnip. The sprout or crown is very good, but especially in the spring, when they begin to run. I should imagine, from the remarkable sweetness of the bulb, that it is more nutritious than the common turnip. The largest bulb I have measured was twenty-three inches in circumference.

I took

I took up a plant in February last, which was sown the August twelvemonth before; which, when deprived of its fibrous root, weighed about twelve pounds; the bulb was considerably elongated, and measured nineteen inches in circumference, and twelve from the base of the bulb to the top of it; it had thrown out forty-six lateral sprouts.

My plants stood the winter of 1788, which was a very severe one, when all my turnips were destroyed. It has been suspected by farmers that the toughness of the rind would form an insurmountable objection to them, as fodder for sheep; but I have this winter had positive proof to the contrary. I have given many of the toughest and oldest to my sheep, which not only penetrated through the coat, but even devoured the greatest part of it.

I do not know where the seed is to be procured in any quantity. I propose to save a great deal this spring, if the season should be favourable.

I am, Sir,

Your very humble servant,

THO. BROUGHTON.

TWERTON,
March 19, 1790.

ARTICLE

ARTICLE XLII.

On the Roota-Baga, the great value of Potatoes to the Poor, and on Turnip-rooted Cabbage.

[By Sir THOMAS BEEVOR, Bart. to the Secretary.]

SIR,

May 3, 1790.

THE plants of the Roota-Baga, which I have preserved for seed, are now in great perfection; the roots are quite sound, and as good as at Christmas; the heads are by no means so large and bushy as those of the turnip-rooted cabbage; they grow up with one single stem with small lateral shoots only, so that whatever may be the comparative value of the roots, the sprouts or heads will not produce near the same quantity of food as the other. Still they seem to me to be most sufficiently inviting to a very extensive cultivation of them; but as the last winter was remarkably mild, their hardiness to endure and abide severe and repeated frosts and thaws, is yet untried. Animals of every kind appear to be immoderately fond of them, leaving all other food for them.

The seed I shall save from them this year will not, I fear, become ripe sufficiently early to sow in this next season; but Lord *Orford*, who is the most communicative,

communicative, as well as the most ingenious and indefatigable experimental agriculturist in this county, has promised to send me two quarts of the feed, part of that which is ordered for his own use; so that if the next winter should prove a severe one, there will then have been a sufficient trial of their merit, to determine whether they can be cultivated with more advantage to the farmer than any of the other winter esculents.

The few mowing cabbages which I have reserved for feed, abound in the most vigorous leaves, which, if after having been eaten down by sheep or cattle, they would sprout again as freely and frequently as after they have been mown down, would certainly prove a most profitable crop; but this, I believe, is yet to be tried.

The great relief which the poor in this neighbourhood have received, and continue to receive, from the use of potatoes, during that price of corn which has made it almost beyond their ability to purchase, will not readily be forgotten by them; the applications I have received this last seed or setting time for those roots, is wonderful, and have exhausted a store of about fourscore sacks, which I had remaining, after having planted my own quantity.

In

In consequence of the very cold weather we have had here, the grass is but just springing, which, as the turnips are wholly eaten up, occasions much distress amongst the farmers, for want of some green vegetable food for their sheep and cattle; whereas, by the assistance of my turnip-rooted cabbages, (at which I have now two hundred sheep, and seventy neat beasts, besides many that are given to horses and pigs) I have an abundance of the best and most nutritive food that can be found them; and which will continue in perfection for a week or two longer, or more, if they should be wanted.—From the conveniency and benefit thus derived from them, I cannot but strongly recommend their culture for the support of almost all live stock for the last three weeks in April, or the first in May, where the grass shoots late; many years experience has made me confident of the value of them.

I am, Sir,

Your obedient servant,

THOMAS BEEVOR.



ARTICLE XLIII.

On the Leith Cart.

[By Dr. J. ANDERSON, to the Secretary.]

SIR,

I USE the freedom to send you a drawing of an implement of labour, not as a new invention, for it has been long used here, but as one of the lightest, cheapest, and handiest implements I ever met with for its purposes. It is the cart universally employed at Leith, for transporting goods of all kinds from the shipping to Edinburgh and that neighbourhood. It consists of a pair of shafts made of fir joined together by five bars of ash or elm, with two deals laid upon them, and a small piece of wood below the cross bars, resting upon the axle, for strengthening the bars; all which are sufficiently plain by inspecting the figure. (See plate I.) The whole of this is so light that a man might take it upon his shoulder, and so strong as to last several years in constant employment. The first cost is from twelve to fifteen shillings, independent of the axle and wheels.

This simple carriage is so contrived as to be yoked or unyoked with the greatest ease; for that
purpose

purpose a pair of round rings are fixed by short chains to the collar of the horse, which slip over the end of the shafts with the utmost facility, and are there fixed by a pin put into a hole. Breeching, because troublesome for yoking and unyoking, is seldom employed.

You will please to observe, that besides the parts already described, there is represented on the mounted cart (it is kept away from the other to shew the construction the better) a cross bar that rises higher than the shafts; through each end of that bar passes an iron pin, which is received into holes in the shafts made on purpose; these holes are wide enough to let the pins be easily drawn out, so that the whole bar, with the pins, can be lifted off with ease, and placed nearer or farther from the axle, as the nature of the load may require.

The great beauty of this implement is the ease with which it can be loaded and unloaded; and the men who are used to them manage this matter with an adroitness and dexterity that has often excited my admiration. Suppose, for example, it is a pipe of wine that is to be conveyed away; in that case, the horse is made to go up to where the wine lies, as near as he can conveniently come, and is then unyoked. The cart in that case stands in the position
here

here drawn, and (the pins not being put in the shafts after unyoking) presents an inclined plane, on which the pipe of wine can easily be rolled up by two men till it comes above the axle, when, by a sudden twist, it is instantly placed lengthways on the cart between the two deals; the cross bar is placed close behind it, the horse is put to the cart, and being bound with ropes to keep it steady, away they drive.

This is done by two men in a very short space of time; but as there is danger if either of the men should accidentally slip his hold when rolling the pipe up, a third hand is usually called in on this occasion, who taking the cart ropes, which are always at hand, slips a noose at each end of the rope over the projecting point at the end of the shafts, the rope is then passed over each end of the pipe, and brought again to the third man, who tightening it as the others roll up the pipe, effectually prevents the danger of its slipping down. It is taken from the cart by a similar operation.

Hogsheads of tobacco and sugar are put upon the cart exactly in the same manner, but as these are not so long as a pipe of wine, they are allowed to lie across the cart. Two of these are usually put upon a cart at once, the cross-bar being placed behind the last to keep it from slipping back; and

as

as the wheels are low, so as to raise the cart higher before than behind, when in yoke they are well enough secured by means of ropes.

When barrels of a smaller size, or large boxes, are to be loaded, instead of taking the horse away, they make him stand still in his place, while the shafts are lifted up so high before as to allow the hinder points to reach the ground, which gives a steeper inclined plane than the former for the same purpose. This is most usually done for sliding up large boxes of any sort; bale goods and small boxes are put upon the cart with the greatest ease by hand, as it is low, and not interrupted by sides of any sort. For grains, bags are made of a convenient length to lie across the cart, and are piled one above another with great ease, and bound with ropes. Every carter usually supplies bags for himself.

It is astonishing to see the quantity of work that will be performed in a short time by these carters with this slight implement. The horses are in general of very little value, few of them being worth more than 5*l.* yet with one of these horses it is usual to carry two hogsheads of sugar or of tobacco from Leith to Edinburgh, which is all up hill, or other loads in proportion. I am persuaded one of our carters with his horse and cart would perform twice

as much work in a day as a London carter with his three large elephants, and his cumbersome cart, which is of itself more than a load for one horse.

Your most humble servant,

JAMES ANDERSON.

Cotfield, 10th Sept. 1789.

ARTICLE XLIV.

On the Vegetation of Old Grain.

[By SAMUEL SMITH, Esq; F. S. A.]

GENTLEMEN,

AS the ascertaining of useful facts in agriculture is the professed design of your Society, any thing that may tend to shew how long seed may retain its vegetative quality, cannot be unworthy your attention.

In the year 1754, my brother, a member of the Bath Society, was at Strasburgh, and seeing some Indian corn growing, he gathered an ear or cone, and preserved it with the flag on it. It had lain by unregarded till last year, when meeting with it, and the date, place, and time of growth being on it, I was induced to try if it would grow. The 28th of
February

February 1788, I took six grains, soaked them in water twenty-four hours, put them in earth in pots, and then in a hot-house. In about twenty days they began to appear, and four out of six grew to about three feet high; two produced the ear compleatly formed, a cone of which I send. The pots were taken out of the house the latter end of June, and the ears gathered the beginning of October. Six other grains were planted in the garden without soaking, but did not produce even signs of vegetating.

From this experiment is ascertained a fact that seed kept dry hath vegetated at the distance of thirty-four years from the time of its being gathered. I am, Gentlemen, &c.

Clapham, Dec. 27, 1789. SAMUEL SMITH.

ARTICLE XLV.

On rearing Calves without Milk.

[To the Secretary.]

SIR,

Tytherton, Dec. 3, 1789.

THE following is as near a calculation of the expences of rearing my calves without milk as I can at present assert. In the year 1787 I weaned seventeen calves, in 1788 twenty-three, and

in 1789 fifteen ditto. I bought in 1787 three sacks of linseed; I put one quart of the seed to six quarts of water, which by boiling ten minutes, became a good jelly; this jelly is mixed with a small quantity of the tea of the best hay steeped in boiling water.

Having my calves drop at different times, I did not make an exact calculation of the expence of this hay tea, but out of my three sacks of seed I had better than two bushels left at last. I gave them the jelly and hay tea three times a day; to the boy who looked after them 6d. per day; the price of the linseed was 4s. 6d. per bushel; the whole three years' feed 2l. 5s.

My calves are kept in a good growing state, and are much better at this time than my neighbours' that are reared by milk; they do not fall off so much when they come to grafs.

I am, your obedient servant,

THOMAS CROOK.

[The foregoing is a succinct but useful account of a method of rearing Calves, which has often been suggested, and deemed practicable, but which the Society had never before known so fully proved. Mr. CROOK (of whose judgment
in



Cooke's Patent Drill Machine *improvd & simplified*
and capable of being converted into a Horse Hoe.

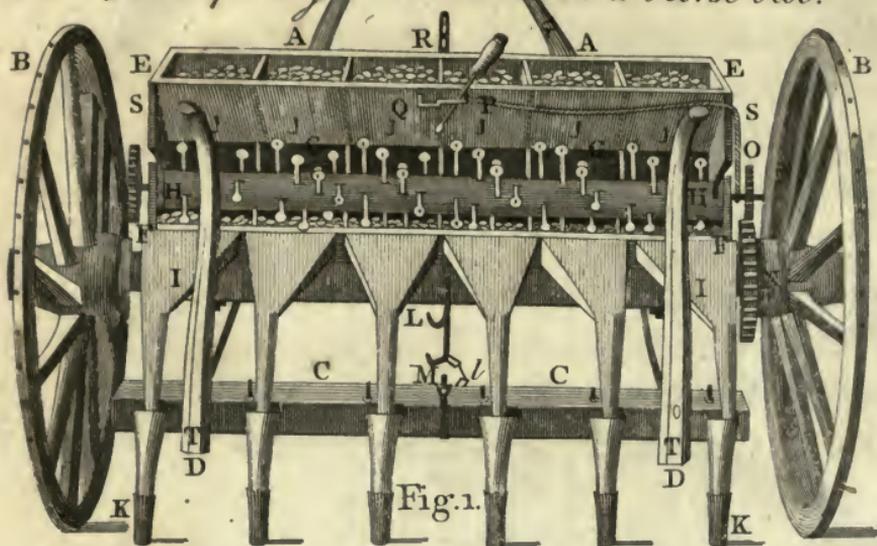


Fig. 1.



Fig. 4.

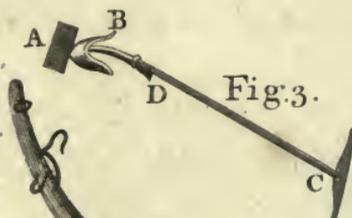
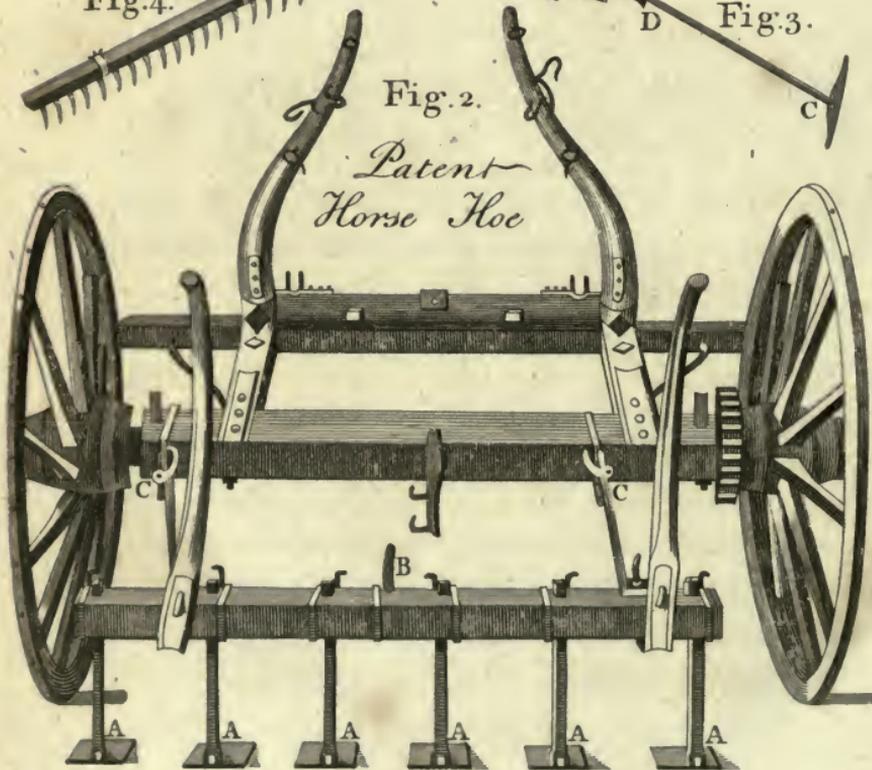


Fig. 3.

Fig. 2.
Patent
Horse Hoe



in cattle the publick is well informed) undertook this business with a zeal which does him credit; and after a small testimony of approbation, by presenting him with a piece of plate, the Society is happy in recommending a practice the value of which Mr. Crook has so well ascertained.]

ARTICLE XLVI.

*On the Rev. Mr. Cooke's newly-improved Patent
Drill Machine.*

THE publick are already well acquainted with the name of Mr. *Cooke*, and his laudable exertions for the promotion of the drill husbandry. His new Patent Machine, confessedly a great improvement on his old one, and vended at the reduced price of twelve guineas, (including the drill hoes, and scarificators) may be obvious from a comparative inspection of the plate annexed, and that given in vol. iii. —But from a motive of respect to Mr. *Cooke*, as well as for the further information of some of our readers, we subjoin the following brief account.

The superior merits of the present improved machine, compared with the old one, consist

1st. In the wheels (B. B. fig. 1.) being so large, that the machine can travel on any road without trouble, or danger of breaking; also from the farm to the field, &c. without taking to pieces; requiring only half the draught which the old machine requires.

2dly. In the coultter beam (C. C. fig. 1, with all the coultters) moving with great ease to the right or left, on a principle of the pentagraph, by which means the drills may be made strait; and where lands or ridges are made four feet and a half, or nine feet and a half wide, the horse may always go in the furrow, without setting a foot on the land, either in drilling or horse-hoeing.

3dly. In the feed supplying itself regularly, without any attention, from the upper to the lower boxes, as it is distributed.

4thly. In lifting the pin M on the coultter beam to a hook L on the axis of the wheels; by which means the coultters are kept out of the ground at the end of the land, without the least labour or fatigue to the person who attends the machine.

5thly. In going up or down steep hills, the feed-box is elevated or depressed accordingly, so as to render the distribution of the feed regular; and the feed being covered by a lid, is screened from wind or rain.

These are some of the advantages appertaining to the above improved drill; which, though considerable in the process of drilling, are as nothing, compared with those which arise from the use of the horse-hoe; of which it may suffice to say, that from eight to ten acres are commonly hoed in one day, with one man, a boy, and a horse, at the trifling expence of sixpence or eightpence an acre, in a stile far superior to, and more effectual, than any hand-hoeing whatever; also performed at times and seasons when it is impossible for the hand-hoe to be used at all,

From

From last year's official proofs and extensive experiments in horse-hoeing, we are justified in saying, that by a proper and seasonable use of the above drill and horse-hoe, the largest farm in this island may be kept as clean from weeds (the bane of all arable lands) as any garden need be, with a clear extra profit of more than the rent of land.

ARTICLE XLVII.

On a new Washing-Machine, by Henry Murrell.

MANY have been the implements and machines contrived to expedite the common operation of washing, and some have even been vended by patent. From trials which have been made of an improved machine introduced to this Society by Mr. *Murrell*, it appears to be very useful, and worthy of recommendation; we therefore have given an engraving of it, [plate 2.] and here subjoin directions for its use.

The night before washing, the linen should be soaked in cold water mixed with some soaper's lye. At the time of washing, have ready a quantity of boiling water, into which has been shred soap, in the proportion of two ounces to twelve gallons, so well stirred as to be all dissolved, with a mixture also of soaper's lye.

Then take out the linen and soap it, as is usually done for boiling; after which, put into the machine about twelve gallons of the above-directed boiling water. Linen the least soiled is first to be put into the machine. Not more than the
 quantity

quantity of six or seven shirts is to be put into each end of the machine at a time, lest the pressers being prevented from opening, the linen will be unable to turn, and of consequence be only partially washed. Then fasten down the doors of the machine, and set it to work; at the end of ten minutes take out the linen, and supply a fresh quantity: the linen taken out is then carefully to be overlooked, and any little remaining stains washed out by hand. After two or three sets of linen, according to the foulness of it, have been washed in the same water, let out some of the foul water, in proportion to its foulness, and supply an equal quantity of that above described from the furnace. Having thus washed all your linen through the first water, repeat the operation with a fresh supply from the furnace, till the whole is finished, then wipe out the machine dry, and leave the doors quite open.

It has been found by experience, that the soaking the linen over night in cold water and soaper's lye, and soaping it also before it is put into the boiling water in the machine, will effectually prevent the dirt from being fixed in the linen.

The advantages of the machine are obvious. The saving of soap, from the more copious use of soaper's lye, which cannot be used in the common way, on account of the washer's hands; nor for the same reason can so hot water be used as in the machine. The saving also of fuel, at least one third; of labour, two thirds; less injury also to the linen than in the common way; and, above all, the hastening one of the most troublesome parts of family œconomy.—A stout lad or man may perform the more laborious part of the process.

ARTICLE XLVIII.

REPORT concerning the Publick Trial of PLOUGHS and DRILLS, which took place near Devizes, on the 21st and 22^d of April, 1790.

IN pursuance of the objects proposed by this Society by publick trials of Ploughs and Drills, the Committee of Gentlemen-Farmers, to whom a choice of ground for those purposes was committed, selected a piece for the former in the parish of Ashleton, and for the latter at Roundway. The spot for the trial of ploughs was a remarkably strong soil, on which wheat had been grown last year, but the most full of couch-grass of any land that could be found. This spot was chosen the better to bring the double-coultered and the lighter ploughs to a severe trial. It was expected that six ploughs of different descriptions would have started for the premiums of the Society, but only four were found in the contest; one or two having declined, on account of the difficulty of the work, and a new swing-plough, lately invented by the Rev. *James Cooke*, being delayed on the road by the carrier.—The four were as follows:

1. The double-coultered plough, belonging to WILLIAM DYKE, esq; at *Syren-Cot*, drawn by four horses two a-breast.
2. The Norfolk wheel-plough, belonging to Mr. PRITCHARD, drawn by two horses without a driver.
3. A light Carlisle swing-plough, belonging to Mr. THOMAS, drawn by two horses a-breast, and driven by a lad.
4. A common Wiltshire plough, belonging to Mr. JACOB GIDDINGS, drawn by two horses, and driven by a lad.

The

The result of this trial we subjoin in the written decisio
of five respectable umpires, chosen for the occasion, viz.

“ We, the Umpires chosen for determining the Premiums
given by the Bath Society for Ploughing this day, do
adjudge the said Premiums as follows:

1st Premium, To Mr. DYKE's two-furrow plough with
four horses, as the best and cheapest plough for general use,
and do recommend the same as a saving both of men and
horses; though, from a fault in the construction of the plough
produced to-day, the furrow was not laid sufficiently flat.

2d Premium, To Mr. THOMAS's single-wheel plough with
two horses; and we do recommend the said plough, as having
performed exceedingly well on a stiff heavy soil.

3d Premium, To Mr. PRITCHARD's plough with two
horses without a driver, as being a plough better adapted for
stiff heavy soil than the general ploughs of the country.—And
the ploughman of the other competitor, Mr. GIDDINGS,
having done his best with an aukward bad-constructed plough
of the county, we think proper to order him a gratuity of
five shillings.

H. J. CLOSE,
STEPHEN NEATE,
WILLIAM SHORT,
THOMAS DAVIS,
THOMAS LEWIS.”



END OF THE FIFTH VOLUME.

