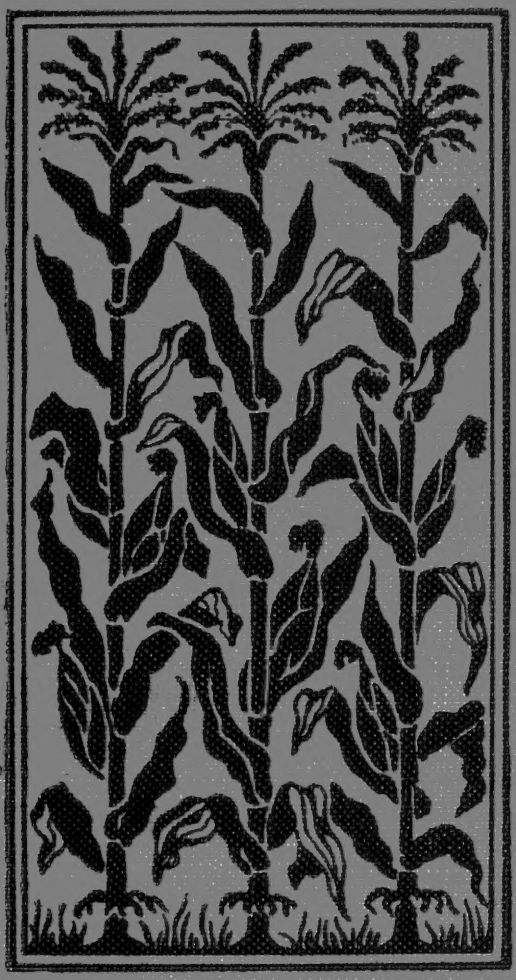
Revised Edition

SOILING

SOILING CROPS & ENSILAGE—BARN, STABLE and SILO CONSTRUCTION

FRANK SHERMAN PEER



TESTIMONIALS.

The following are a few testimonials of the first edition published in 1881. The present edition is much larger and better in every respect.

From W. E. Simonds, Hartford, Conn.:

Your book is really a *valuable* one. I think I know what among the vast amount of agricultural rubbish is valuable. My mental classification of your book is alongside Waring's book on Drainage, and I consider that a very honorable companion.

From W. G. Markham, Avon, N.Y.:

Your work on Soiling is not only well written but exceedingly interesting and instructive, and must be a most valuable work, which ought to be read by every farmer and dairyman in the country.

From Erich Parmly, New York City :

I am reading your valuable work on Soiling and Ensilage and find it very instructive. I must put it into practice and get rid of some interior fencing. I have about seven miles of fencing, enough to make a man poor.

From Wm. Kent, Palmyra, N. Y.:

The best book on agriculture I ever read.

From Chas. Woolcott, Canton, Ohio:

There is more common sense agriculture in Mr. Peer's work on Soiling than in any book on farming I ever read. It should be a textbook in every agricultural college and every farmer's son should read it.

From Country Gentleman, Albany, N. Y.:

The work contains a forcible summary of the arguments in favor of Soiling, together with a concise statement of the author's personal experience, including the arrangement of buildings, both as regards Soiling and Ensilage.

Rural Home, Rochester, N. Y.

We have referred to Mr. Peer's system of soiling his stock of all kinds on occasions of two visits to his farm. We would advise farmers and dairymen to obtain this book and study it.

Philadelphia Weekly Press.

The book is a strong presentation of a system which must ultimately come into general use. We hope the book will have a wide circulation.

Newark Courier.

Mr. Peer is a practical man who has made agriculture a study, and by his original and progressive ideas has placed our farming people under great obligations.

Soiling, Ensilage, *and* Stable Construction

BEING A REVISED EDITION OF SOILING, SUMMER AND WINTER; OR, THE ECONOMY OF FEEDING FARM STOCK

BY

FRANK SHERMAN PEER

Relating the experience of the author, giving the latest and most economical methods of summer and winter feeding and management of farm stock; also the construction of stables

WITH ILLUSTRATIONS

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REVISED EDITION

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DEDICATION

To the farmers' sons of America this book is dedicated, with the best wishes of the author, and with the hope that within its pages they may find encouragement to pursue agriculture as a business, instead of leaving the farm for some so-called higher pursuit. . . . . .

INTRODUCTION TO THE FIRST EDITION.

THERE is little need of a formal introduction to the subject of soiling. Most farmers and dairymen are more or less familiar with the subject through inquiries and articles that from time to time appear in the agricultural papers. To others who may chance to peruse these pages, I may say that the work is designed to answer the following perplexing questions, *i.e.*, How can a farmer enrich his soil in a sure and economical manner? how supply his farm stock with the most nutritious food at the least cost? how obtain a full flow of milk from his cows during the entire season independently of parched pastures? how increase the number of farm stock or the acreage of the farm without buying more land? how may the Eastern farmers successfully compete with the immigrant farmers of the West?

An attempted solution to these and kindred questions will be found in the following pages.

In relating my own experience in conducting this system of feeding, and the wonderful results obtained, I hope my readers will not accuse me of boasting of what *I* have done, or of what *I* can do.

Nearly every farmer may practise the system with the same or even better results. Each year's experience reveals many new advantages of the system.

I do not pretend that my conclusions will be found infallible under all circumstances, but I hope to show how the system was applied to my own farm, that the reader may obtain a clear view of its workings, and be enabled to carry on the system with such alterations as the different conditions under which he is placed shall suggest.

I am not farming for pleasure, although I find a good deal of pleasure in farming. I follow farming for my daily bread, and the profit there is in the business. My farm operations are not supported by a profitable business or profession in town.

I mention this that my readers will clearly understand that although this work contains some radical departures from "General Farming," they are not to be entertained by the experiences of a "fancy farmer," a "book farmer," or a "city farmer."

I have no apology for presenting this subject in book form. I humbly acknowledge that it is not written at "the earnest solicitation of numerous friends," but because I am very much interested in farming as a business or profession, and I would be pleased to see more of our intelligent young men engaged in this pursuit.

As a literary writer, I make no pretensions. If this work is well received, it must be entirely on its merits as a record of the personal, practical experi-

ence of a farmer; and if the reader finds as much pleasure in perusing these pages as it has given me to write them, I shall feel that my labor has not been spent in vain, nor the reader's attention claimed for naught.

Maple Lane Farm,
East Palmyra, N. Y., 1881.

INTRODUCTION TO SECOND EDITION.

THE first edition of "Soiling, Summer and Winter" has been exhausted since 1885. I have been trying to find time ever since to go over the ground again and present the work in better form, but the convenient season has ever seemed to be to-morrow, so that between business cares on the one hand, and the thief of time on the other, weeks have stolen into months, and months into years, leaving the work unfinished.

There was another reason (but I never liked to let myself admit it). I felt that my work on soiling was a little premature, and I have been waiting for a sign that would indicate that it was wanted.

I published the 1880 edition myself, because no publisher could be found who had the courage to undertake it. In the mean time, the Farmers' Institutes were inaugurated throughout the country, and Experimental Stations in nearly every State are delving into every possible nook and corner in a legitimate strife among themselves to be the first to master and give to the public the latest ideas in regard to every known subject pertaining to agriculture. So that, in a great measure, they robbed one of that

zest and force necessary to sit down to a task of writing a book on any agricultural subject.

I was subjected to much ridicule for my early endeavors to introduce soiling, which was called "book farming" and "fancy farming," etc. And when, late in 1878, I built a silo, and came out strongly in favor of ensilage, it was thought by many to be the climax of folly, while others suggested that I "might have gone wrong in the upper story." In these days (1875 to 1880) I went about the State visiting farmers' clubs, and discussing soiling and ensilage. I was quite young at the time, just out of my teens, and my views—however reasonable they appeared while I was before my audience—lost much of their force, I fear, on account of my youthful appearance. However, I kept on talking soiling, in season and out, until the Farmers' Institutes were established and ensilage at least became a popular theme.

Ensilage has produced quite a revolution in farming, but that is only "winter soiling," and has not accomplished half of what may be done by pursuing the method all the year round, for, as I have always claimed, summer soiling has many advantages over winter soiling, as will be shown further on, so that, although ensilage has made such wonderful strides, it by no means represents the best half of the system.

"Why then," it may be asked, "has ensilage preceded soiling?" Principally, I believe, because it was a new and startling discovery, and required an outlay of capital to begin with. Soon after ensilage

made its appearance, manufacturers of feed cutters sent catalogues and circulars (advertising their machines) broadcast over the country, agents canvassed towns, exhibited their machines at fairs, and told exaggerated stories of the advantages to be gained by ensilaging corn fodder. They said that ensilage was a good thing, and that their particular machine was the *only* thing. Ensilage being a new departure, a new discovery, the agricultural papers were full of it, and later it became a popular theme for discussion at the Farmers' Institutes, where it was listened to because it was new and sensational.

Soiling, on the other hand, was a question that every farmer was familiar with. Few could be found but that had practised it to the extent of cutting clover green, and feeding it to their workhorses in the barns, or had sown a patch of corn for their cows to be fed over the fence in the pasture field to help out the pasture in a dry season. In doing this they never discovered anything very wonderful, or striking, or sensational, as was the case in the introduction of ensilage.

No one talked soiling, and altogether it had little to force itself upon the attention of the public.

Soiling has been unfortunate in not being properly introduced. No one in all the country has a farthing to gain out of the farmer by advocating the system or encouraging its adoption.

I have lived long enough to discover that people will listen to good advice, and admit that it is good advice, but if they can obtain it for nothing, it is

seldom appreciated, and rarely made use of. I believe that if it required an investment of a thousand dollars in patent machinery, the soiling system would long ago have been adopted on thousands of farms, where to-day it is not practised at all, or only done by halves. People appreciate everything by what it costs.

Soiling costs absolutely nothing by way of new machinery or buildings, other than can be found on any well-equipped farm. I repeat that ensilage—winter soiling—has produced quite a revolution in agriculture, but summer soiling is as much more desirable and beneficial than winter soiling or ensilage as ensilage is better and more economical than hay and dried cornstalks.

Another hindrance in America to the adoption of soiling is that our farms, as a rule, are too large, and the rather mistaken notion that if a person can make money on a hundred acres, he can make seven times as much on seven hundred acres. The farmers and dairymen with small farms will be more easily convinced of the practicability of soiling than the owners of large farms. Nevertheless, soiling is coming. I have watched its advancement with great interest, although it has not yet become a fashionable question for discussion at Farmers' Institutes; and although the experimental stations have hardly touched upon it, there are unmistakable signs that farmers of the Eastern States are ready for it. Last year I had the pleasure of attending quite a number of Farmers' Institutes in different

parts of the State, and I noticed there was hardly a question box opened but that contained one or more questions bearing directly on the subject.

I came home from attending these meetings, and have since taken up the pen with renewed courage, and feel sure that now I shall have the pleasure of telling the good news to thousands who, a few years ago, had little or no interest in the subject.

In revising this work, I have made but little alteration in the text and main features of the first edition. I am able, however, to bring to this work more extensive experience with certain soiling crops, which at that time I knew little about. I refer to sorghum and lucern for cattle and rape for sheep. These I have enlarged upon considerably also a few new plants are mentioned, such as crimson clover, etc.

In winter soiling the principal changes are in handling the crop and the construction of the silo.

I believe I have given due credit to the agricultural press and agricultural writers whom I have freely called upon throughout the work.

I have found that re-writing a book is a more difficult task than producing the original. I have been obliged to do this work at odd times while travelling by rail, stopping at uncomfortable hotels, or while making a winter's trip across the Atlantic. I feel, therefore, as the manuscript leaves my hand, that it somewhat resembles a clock that the great temperance lecturer, John B. Gough, was fond of telling about, to the effect that when its hands

pointed to twenty-five minutes past four, and it struck seven, he knew it was just one o'clock. So with this work, it matters little how the hands point or how it strikes, if you only understand that it always strikes for soiling.

I hope this work will prove a handbook and guide to soiling. I have dwelt quite at length upon subjects leading up to the work, that the fundamental principles of the system and its advantages may be firmly established. This I hold to be more essential than the methods of soiling themselves, because if the reader has a foundation that is safe and to which he can always return, although the conditions under which he may find himself may differ materially from my own, he will be able to cut a new line for himself.

This work is, so far as the details are concerned, but a row of blazed trees through the forest. My effort has been, therefore, more to present the principles and advantages of the soiling system so they shall be clear, unmistakable, and undeniable, and if I shall be so fortunate as to accomplish this in the following pages and impart to my reader the *will*, my purpose shall have been accomplished, and his own good judgment may be depended upon to find the *way*. In that case he may make mistakes and meet with disappointments. He may stumble and even fall, but in getting up he will always be getting on in the right direction.

Many have started soiling, but in a half-hearted way, and have given it up on account of some little

hitch in the management. They have become discouraged simply because they failed to see the great benefits to be gained. Others have tried partial soiling; in this they have experienced nearly all the disadvantages and not over a quarter of the benefits. Others are convinced that it is the thing to do, but are afraid of what their neighbors will say if they should branch out in any new line. I have been through all this; the lions in the way are not half as ferocious as they look at a distance, and although there is always a rod in pickle for any man who would be wiser than his generation, the reward is more than ample compensation for all such cuts. "He laughs best, who laughs last."

Squawkie Hill Farm,
Mt. Morris, N. Y., 1899.

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CHAPTER I.

OUR SOILS.

The great problem of feeding and clothing the millions depends upon the success of agriculture. The day has gone by, in the Eastern States at least, when a man can "farm it," because he does not know enough to do anything else. There is no business or profession in which a man is obliged to have such a diversity of knowledge as in farming. Every day brings him face to face with widely different questions. There are his cows, their management, breeding, care, feeding, the disposal of their product. Likewise his sheep, horses, swine, poultry, bees. Then there are his fruit trees, different varieties, requiring special care and attention, and special knowledge. There is, as I said before, not a trade or profession requiring such a widely diversified knowledge as general farming.

Our predecessors who, through ignorance, robbed the soil of its fertility, left us little—in these days of keen competition—but a legacy of unprofitable labor. We ought to profit by their mistakes, and find some way, if possible, to make our land more productive.

Any fool can rob the soil of its fertility, but it takes a wise man, a professional agriculturist, to win it back to productiveness. If we do not succeed in doing this, we shall leave to our children a legacy which they will spurn, instead of one they could receive with rejoicing, and that one must be capable of supplying their increasing numbers and their increasing wants.

Farming on an Exhausted Soil.*

I regret to say that the history of agriculture in America is any but one to which we may point with pride. What, may I ask, has become of the many farmers throughout the New England States who once lived comfortably, if not luxuriously? Why are their farms deserted, their houses unoccupied? We have not far to look for the answer—the fertility of the soil has been exhausted, sold in the markets of New York and Boston by the pound, by the bushel, and by the ton. Their owners, failing to find their toil longer remunerative, have gone West, many of them, where I presume they have gone on systematically robbing the soil, leaving to their descendants a heritage of unremitting toil. Still more lamentable is the condition of thousands of farms in Virginia and other parts of the sunny South. Here, but a few years ago, lived a people who boasted of their wealth, their refinement, their culture, and their chivalry. Why are their once beautiful fields

* Extract from an address delivered by the author at Albany, N. Y., before the County Agricultural Society in 1890.

now fenceless and deserted? The land remains, the climate remains, the slaves remain, but the owners are not. The fertility of the soil went before them; they baled it with their cotton, barreled it with their sugar, until naught remains but the barren soil.

A few years ago the term "out West" was synonymous with bounty and fertility. We were told that one had but to "tickle the soil with a hoe, and it laughed a harvest." All this has changed. Their average yield per acre during the last ten years has declined twenty-five per cent.

Farming on Productive Soil.

Happily, however, this state of things, with a proper knowledge of agriculture, is unnecessary. There is a way, not only to maintain the fertility of the soil, but to increase it. England has been under the plow for centuries, still her average yield of wheat has increased to over thirty-one bushels per acre, while the average yield in this country has steadily declined until it is only about thirteen bushels per acre. China, one of the oldest countries in the world has increased the agricultural resources of the empire to keep pace with the rapidly increasing population. It is a fact that the heathen Chinee knows better than we how to preserve and increase the fertility of the soil. If America would close her eastern gates to emigrants who come here to rob our soil, and let a few Chinamen farmers in at the western gate, we might learn some valuable lessons in farming. Fertility means prosperity.

There is not a fertile spot on the face of the earth but that is a prosperous one and a desirable one in which to live.

The Condition of Farming at the Present Day.

The problem that confronts the present-day farmer is how to compete with the foreigners who come to this country annually by the tens of thousands, and who, on their arrival, our Government sets up in the farming business, offering to each one hundred and sixty acres of land. The only alternative we have in competing with these Government farmers is to do one of two things. We must either get down to their level, and work as they work, our wives and children constituting our hired help on the farm and in the house, live as they live, half fed and half clothed, go without books and papers, without recreation for ourselves or an education for our children. That is one way, but even then we cannot hope to compete with them on farms that cost us a hundred dollars an acre, and on which we are taxed to support all sorts of charitable institutions, to say nothing of (as in this State) building state capitols and digging canals to benefit the adopted children of our Government, while at the same time they have their farms given to them.

Farming on Government Lands.

A foreigner comes to this country with money enough to pay his fare to some of the Western States. Uncle Sam gives him a farm, then he finds

plenty of men ready to take a mortgage on it for enough to enable him to purchase the necessary tools, and there you see him a full-fledged American farmer. It is, indeed, a most serious predicament in which the public land policy of our Government has placed the farmers of the Eastern States. They are not only made to sell their products at cost and less, but their lands have depreciated in value fifty to seventy-five per cent., until many farmers in the Eastern States have been driven to bankruptcy, all for the sake of keeping up that boastful, useless, wasteful practice by the Government "that Uncle Sam is rich enough to give us all a farm," and of setting up thousands of foreigners annually in the farming business until competition is so keen that there is nothing left the farmers in the older States but unremitting toil. Their sons and daughters are thereby driven from the farm, and their places are being filled by foreigners, until we are fast becoming reduced to the condition of the peasant farmer of the old world. Farmers they are not. They are, more properly speaking, a lot of land pirates.

They have a good farm given them, and immediately they begin to live on its fertility like a lot of highwaymen. Have I overdrawn the picture? I wish you might say I had. If you think so, look about and see how many one hundred, one hundred and fifty, or two hundred acre farms there are in your county, where the hired man gets about all the yearly profits, while the owner, with a ten or twenty thousand dollar investment, and his wife as

well, work for their board and clothes. Farmers themselves are largely to blame for this state of things. They should demand through their representatives at Washington that the Government put a stop to the giving away any more of the public domain, until there is a demand for it at $10 or $15 per acre.

No other business men would put up with such an infringement. The United Workmen said prison labor must cease, because the State was setting up laborers in competition with them, which it had no right to do, and prison labor ceased. The United Workmen said to the United States Government, "Put a stop to the contract laborers coming to this country to compete with us," and the law was passed. If an immigrant is engaged to come to this country to dig a sewer, the Government at Washington sends him back to the country from which he came. The same United States Government says to the same immigrant and to every other foreigner, "You come over here, and Uncle Sam will give you one hundred and sixty acres of land; that is to say, will set you up in the farming business."

"Come from any nation,
Come from any way.
Come along, come along,
Don't be alarmed:
For Uncle Sam is rich enough
To give you all a farm."

So goes the old song. When the country was new, this could be done without injury to any one.

But that day has long since passed. These Government farmers have increased so rapidly that agriculture in the Eastern States has been reduced nearly to a level with immigrant farming.

This, in short, is the present condition of agriculture in the Eastern States. There is left us but one alternative, either to live as the immigrant farmers live, work as they work, or to cheapen our production by making one acre produce what now comes from four or five.

I offer you this solution: I bring you in this volume a ray of hope. *Try soiling.*

CHAPTER II.

OUR PLANTS.

How to Feed Them.

Our plants, like our animals, live, feed, grow, and die. It is only by feeding them alike liberally that we can hope to make them produce bountifully.

Until a person comes to consider his growing plants as if they were his growing animals, claiming his care and attention, and looking to him to supply them, largely, with the food they must consume, then, and not till then, is he in possession of the principles that constitute successful farming. At first glance it would seem that the above statement was so self-evident that there was little use of mentioning it, but when we look about a little and notice the way that many farmers starve their growing plants, even when they do not starve their cattle, it shows that they have never looked at their growing plants in this light.

What has this to do with soiling? It is the principal thing, as a celebrated English general once said in reply to the War Department, which said to him: "General, it seems to the War Department that the thing that most concerned you in India was the growing of forage for bullocks." "Yes, sir; that's

the principal thing in carrying on a successful warfare in India or any other country. If we have the forage, we shall have the bullocks; if we have the bullocks, we shall be able to support the men, and if our men are well supported, we shall have no trouble to conquer the enemy." That's the whole story. If we will give our greatest concern to our growing plants, we need not worry ourselves about the rest. The animals to eat it will come along easily enough. If you see it in that light, you will find, by the adoption of the soiling system, that you are able to provide an abundance of food for your growing plants in a sure and economical way, *i.e.*, by the greater production of barnyard manure, plowing under green crops for manure, soiling your plants as well as your animals. But before we proceed to discuss the value of barnyard, liquid and green manuring as compared with commercial fertilizer, let us first consider the comparative value of the ordinary grain and forage crops, both as a forage (manure) for our plants and as feed for our animals. This will help to explain some important questions in regard to producing the most economical plant food and clinch several strong arguments in favor of soiling.

"Good farming," says Lockhardt, "consists in taking large crops from the soil, while at the same time you leave the soil in better condition for succeeding crops." This strikes me as being the best definition of what constitutes good farming I have ever seen. It is the very science of farming.

Good crops make good manure, good manure produces good crops.

The value of grain and forage crops for plant food consists in the amount of nitrogen, phosphoric acid, and potash that they contain, while the value of forage crops and grains for animal food depends chiefly upon the amount of albuminoids, carbohydrates and fat they contain.

Animals, in the consumption of foods, take from them but a small proportion of their value for plant food, while the plants consume little or none of the elements that the animals require. Thus, if a ton of feed, say cotton-seed meal, should be plowed under as a fertilizer, as is often done in the Southern States, it would be of no more value to the land than if it had been first fed to the stock, providing none of its value as a plant food had been allowed to waste in the manure pile. Some plants or grains are very rich or valuable as plant food, while others are richer in animal food, and again others are valuable for both purposes.

The following tables will furnish the reader some curious and interesting facts, and some information which will assist him, it is hoped, in making a most economical selection.

The analysis from which the values of the different foods are estimated was taken from the work of Dr. Emil Wolff of the Royal Academy of Agriculture, Wurtemburg, Germany. I believe these extended tables, as prepared by myself, were the first of the kind to appear in print in this coun-

try. They represent the average results of numerous analyses, and are sufficiently accurate for all practical purposes. The original analysis represented only the comparative proportions of different foods as given in 100 and 1,000 lb. With these figures as a basis, I have estimated the number of parts or pounds found in one ton (2,000 lb.) and computed the animal food value per ton, estimating albuminoids at $4, carbohydrates at 80 cents, fat at $4 per hundred pounds.

These estimated values are obtained from the average prices of the different grains in market, but as the prices vary in different localities and in different seasons, they cannot be said to be absolutely correct at all times. But they may serve to show the relative values of the different kinds of feed and forage. For instance, if the value of any one article is too high or too low, then all the others are correspondingly so.

In calculating the value of the different grains and forage crops as plant food, I have taken the market price of nitrogen at 15 cents, phosphoric acid at 6 cents, and potash at 5 cents per pound.*

* These estimates were made for the first edition. At the present time, nitrogen, phosphoric acid, and potash can be bought in certain forms for about one cent cheaper per pound.

Grains.	Pounds of Animal Food Per Ton.			Value as Feed Per Ton.	Pounds of Plant Food Per Ton.			Value as Manure Per Ton.
	Albumen.	Carb. Hyd.	Fat.		Nitrogen.	Phos. Acid.	Potas.	
Field beans	510	910	40	$29.21	81.6	17.2	26.2	$18.04
Field peas	448	1,046	50	27.38	71.6	17.2	19.6	15.78
Tares (vetches)	550	844	54	30.91	88.0	20.0	16.2	19.04
Indian corn	200	1,360	140	24.48	32.0	11.8	7.4	7.16
Wheat	260	1,352	30	21.51	41.6	15 8	10.6	9.36
Rye	220	1,384	40	21.41	35.2	16.8	11.2	8.16
Barley	190	1,332	50	20.25	32.0	15.4	9.0	7.37
Oats	240	1,218	120	24.14	39.4	12.4	8.8	8.72
Buckwheat	180	1,192	50	18.64	28.8	11.4	5.4	6.43

Ground Feed and Refuse.	Pounds of Animal Food Per Ton.			Value as Feed Per Ton.	Pounds of Plant Food Per Ton.			Value as Manure Per Ton.
	Albumen.	Carb. Hyd.	Fat.		Nitrogen.	Phos. Acid.	Potas.	
Cotton-seed meal	660	352	324	$42.66	98.0	56 2	29.2	$23.00
Linseed meal	566	826	200	37.24	90.6	32.2	24.8	20 40
Corn meal	200	1,360	140	24.48	32.0	11.8	7.4	7.16
Malt sprouts	460	894	50	27.55	73.6	36 0	41.2	17.80
Brewer's grains	98	222	32	6.97	15.6	8.2	1.0	3 48
Wheat bran	280	1,000	76	22.24	44.8	54.6	28.6	12.28
Rye bran	290	1,070	70	22.96	46.4	68.6	38.6	13.56
Rape cake	566	670	180	35.20	97.0	35.4	24.8	21.80

Dry Forage. (Hay and Straw.)	Pounds of Animal Food Per Ton.			Value as Feed Per Ton.	Pounds of Plant Food Per Ton.			Value as Manure Per Ton.
	Albumen.	Carb. Hyd.	Fat.		Nitrogen.	Phos. Acid.	Potas.	
Red clover	268	598	64	$18.06	39.4	11.2	36.6	$9.78
Timothy	194	976	60	17.96	31.0	14.4	40.8	8.40
Lucern	394	858	66	25.26	46.0	11.0	30.6	10.86
Tares, cut in blossom	284	706	50	19.00	45.4	21.4	56.6	12.20
Peas, cut in blossom	286	736	52	19.40	45.8	13.6	46.4	11.56
Orchard grass	232	814	54	17.95	31.0	8.2	26 4	7.58
Wheat straw	40	604	30	7.63	9.6	4.4	12.6	2.60
Rye straw	30	540	26	6.56	8.0	4.2	15.6	2.39
Barley straw	60	656	28	8.75	12.8	3.8	18.8	3.46
Oat straw	50	764	40	9.71	11.2	3.8	17.8	3.10
Pea straw	130	704	40	12.42	20.8	7.0	20.2	5.24
Bean straw	204	730	20	14.80	32.6	6.4	37.0	8.24
Cornstalks	60	720	22	8.98	9.6	10.6	19.2	3.01

Green Fodder.	Pounds of Animal Food Per Ton.			Value as Feed Per Ton.	Pounds of Plant Food Per Ton.			Value as Manure Per Ton.
	Albumen.	Carb. Hyd.	Fat.		Nitrogen.	Phos. Acid.	Potas.	
Grass	60	258	16	$5.10	10.8	3.0	9.2	$2.64
Clover (red)	66	154	14	4.43	10.2	8.8	2.8	2.50
Lucern	90	156	12	5.32	14.4	3.2	9.6	3.38
Tares (vetches)	62	152	12	4.22	11.2	4.6	12.2	2.90
Peas	64	164	12	4.25	10.2	10.2	3.0	2.56
Oats	46	176	10	4.14	7.4	3.4	15.0	2.21
Rye	66	298	18	5.74	10.6	4.8	12.6	2.81
Corn	22	218	10	3.02	3.8	2.6	8.6	1.20
Hungarian millet	118	300	30	8.32	20.0	2.5	17.0	4.78
Sorghum	50	306	28	5.56	8.0	1.6	7.2	1.95
Cabbage	30	126	8	2.52				
Rape (leaves)	400	950	40	25.20	9.2	2.8	8.0	2.26

Roots, Etc.	Pounds of Animal Food Per Ton.			Value as Feed Per Ton.	Pounds of Plant Food Per Ton.			Value as Manure Per Ton.
	Albumen.	Carb. Hyd.	Fat.		Nitrogen.	Phos. Acid.	Potas.	
Potatoes	40	420	6	$5.20	6.8	3.8	11.4	$1.96
Turnips	64	340	12	5.74	3.6	1.8	6.6	1.05
Field beets	22	182	2	2.31				
Sugar beets	20	308	2	3.43	3.2	1.6	7.8	1.01
Carrots	30	216	4	3.08	4.4	2.0	5.6	1.18
Pumpkins	26	56	2	1.56				

Barn-yard Manure.

The manure heap is the farmers' bank. His drafts will invariably be honored at any banking house in proportion to the amounts of the deposits in his compost pile. But it is a mistaken notion to think that manure of one kind is as good as another kind of similar bulk. The foregoing table shows that a ton of clover hay contains $9.75 worth of plant food, a ton of cornmeal only $2.60, while

the same weight of cotton-seed meal is worth $23. Clover hay is worth more than timothy, both as a food for animals and plants. The particular value of timothy hay for horses is that it contains a larger percentage of carbohydrates (muscle-forming food), and is, therefore, better for animals requiring muscular exercise than clover which contains more fat. I wish to call your attention to green lucern, oats, and peas cut in blossom. Also rye, and especially rape, of which I shall have considerable to say under the head of crops for soiling sheep.

There are many interesting facts to be found in the tables, which I have not space to enlarge upon, but which I cannot too strongly recommend the reader (not already familiar with the facts they set forth) to study carefully. By so doing a person may make his selections of feeds with economy. For instance, he might well afford to sell corn and buy oil meal, cotton-seed meal or wheat bran.

Personally I have great dislike to feeding corn-meal to any degree of excess, even to hogs. Fed to dairy cows, I believe, it has done a great deal to ruin what might otherwise have been a good dairy animal by making it a beefer. By feeding it to dairy cows before their calf is born, the calf is brought into the world with a greater tendency to fatten than its mother had. And afterward, when they reach their maturity, it helps them along in the same direction toward completing their ruin as high-class dairy cattle, while in beefers it makes tallow

instead of meat, and in the hog, grease instead of pork. Oil cake, old process, can usually be bought for $5 per ton more than the price of corn. It is worth $13 a ton more as a food for animals, and $14 per ton more for manure. Cotton-seed meal shows a still greater difference in value, and is worth about three times as much both as animal and as plant food.

No one can be found, except perhaps commercial fertilizer agents, but will admit that no commercial fertilizer was ever made that takes the place in the soil of barnyard manure. Says Prof. W. A. Atwater: "Stable manure contains *all* the ingredients of plant food. It is a complete fertilizer. Nor is that all. It improves the texture of the soil; it tends to regulate the supply of moisture, and it helps to set free the stores of inherent plant food which every soil contains." That is the whole story in a nutshell. And if every farmer would commit it to memory, and do his utmost to increase its manufacture on his own farm, it would save not thousands but millions of dollars that are now yearly spent in the purchase of artificial fertilizers. A ton of oil cake fed and made into manure is worth as a manure, according to the table above, $20.40. Take the same amount of nitrogen, phosphoric acid, and potash in a ton of commercial fertilizer, and it cannot be bought for less than about $30 per ton. In other words, a ton of oil meal is worth as much, ton for ton, as a fertilizer as any commercial brand that can be bought for $30. That amount of money

would buy at least two tons of bran. So I might go on through the whole list of farm grains and by-products, and set them up beside commercial fertilizers, and in point of economy it makes a very bad showing for the latter, as will be seen by the following table:

	Pounds of Plant Food Per Ton.			Value Per Ton.	Cost Per Ton.
	Nitrogen.	Phos. Acid.	Potash.		
Clover hay	39.4	11.2	36.6	$9.78	$10.00
Oil cake	90.6	32.2	24.8	20.40	28.00
Wheat bran	44.8	54.6	28.6	12.28	15.00
Cotton-seed meal	98.0	56.2	29.2	23.00	24.00
Fertilizer A	45.0	200.0	90.0	23.25	30.00
Fertilizer B	65.0	200.0	33.0	25.55	32 00
Fertilizer C	70 0	250.0	40.0	31.00	37.00

The amount of nitrogen, phosphoric acid, and potash given in commercial fertilizers is estimated by the analysis given on the sacks. The cost per ton in the last column is the price the fertilizers are sold at. I have given to the nitrogen, phosphoric acid, and potash found in the fertilizers the same values as in the hay and oil meal. The real value of the hay and oil meal compared with commercial fertilizers in the above analysis is seen at a glance. It makes the strongest possible argument to the economy of barnyard manure. We still have in the oil meal and the clover hay its value as an animal food; besides, as Professor Atwater says, "barnyard manure is a perfect fertilizer," which few, if any, commercial fertilizers ever claim to be. Every farmer

admits, no doubt, that it is desirable to get as much barnyard manure as possible, but he says that he does not know how he can possibly keep more stock on his land, which will not support what he already has as they ought to be supported. How then is he to keep any more? We shall see later on that it is a very simple trick.

Green Crops for Manure.

This chapter might properly be called "Soiling Our Plants." And it is to help answer the question, How enrich our farm in a sure and economical way? It may not be convenient for some of my readers, in adopting soiling with a view of obtaining a greater amount of barnyard manure, to be able to buy the additional number of animals that may be supported by such a system of feeding. He may also be, like the author, opposed, even if he had the means, to buying commercial fertilizers. Not only that, but one of the first lessons taught the person who attempts to soil is the importance of having rich soil on which to grow his soiling crops. If he cannot buy the cattle to make the manure, or if he cannot buy the manure, he can at least grow it, and even after he has the cattle bought, he will always find it greatly to his advantage to have on hand as much green manure as possible, to plow under every year. Although this subject perhaps belongs further on under the management of soiling crops, I have decided to put it in here with the question of manures in general, especially as it fits in very well after

what has already been said in regard to barnyard manures, etc.

"Ordinary barnyard manure," says Mr. Harlan in his most excellent work on "Farming with Green Manure," "contains ten pounds of nitrogen, five pounds of phosphoric acid, and twelve and one-half pounds of potash." By referring to the above table, we notice that a ton of green rye is worth just about as much. I have seen some wonderful results in the improvement of land by plowing under a crop of rye. I once rented a piece of land—seven acres—adjoining my farm, that had for a great many years been used in connection with the Methodist parsonage of the place. Every minister that came took from it all that he could during his three years or less, so that finally it would hardly grow mulleins. The first season, it was in grass. We drew the whole crop to the barn in two loads and a half, about as many tons. We plowed it up and sowed it to rye, plowed the rye under the next spring and sowed it to Hungarian millet; plowed that under and sowed it to wheat, and harvested thirty and one-fourth bushels per acre the next season, and cut from it the following year at least ten tons of hay. No other fertilizer was used. I have also had equally wonderful results with following rye with oats and peas, to be plowed under for wheat, instead of summer fallowing.

Land in a good state of cultivation will produce from five to eight tons of green rye per acre. A ton of green rye contains nearly $3 worth of plant

food, and which amount of fertilizing material will cost nearly double that price in the form of commercial fertilizer.

Dr. Hamlin says: "When we compare it (rye) with barnyard manure, its greatest value as a green dressing becomes apparent. I have seen fifteen tons per acre growing on the 8th of May, and this was ascertained by careful measurement."

This makes indeed a very cheap fertilizer, viz.: seed, $2, and interest on the value of the land from October until May (eight months), $4, or a total cost of only $6 for fifteen tons of green manure. The same amount of barnyard manure could not be bought, drawn to the field, and spread for less than $20. The great advantage of rye is that it occupies the ground late in the fall and early in the spring, so that little time is lost by using it to plow under, but of this point I will speak later under the subject of soiling crops. Oats and peas make one of the very best green crops for manure.

Hungarian millet grows quickly, and is without doubt one of the very best quick-growing green manure crops for the Northern States. It is worth, green, to plow under, $4.78 per ton. Twelve to fifteen tons to the acre is a fair crop on good soil.

The value of clover as a crop to turn under is well known, but a crop of millet is quite as good, and can be grown quicker and at less expense.

The great economical feature of green manuring is that it is delivered on the spot, evenly spread, at such a trifling cost. Sixty pounds of seed should

produce twelve tons of green millet, containing nearly $60 worth of manure, and that is not at commercial fertilizer prices either.

Cow peas are largely grown in the Southern States to reclaim the worn-out tobacco and cotton soils, and its value for this purpose is incalculable. My personal experience with it has been limited to two or three trials. The following interesting information taken from the United States Bulletin, No. 16, shows us why the cow pea and other leguminous plants like clover, etc., are particularly adapted to plowing under for green manure (by E. W. Allen):

"Green manuring, or plowing under green crops raised for the purpose, is one of the oldest means for improving the fertility of the soil. It was advocated by Roman writers more than two thousand years ago. Its advantages are many. It furnishes the surface soil with a supply of fertilizing materials, increases the humus and improves the physical qualities and tilth of the soil. As a humus former, green manure stands next to barnyard manure. Green manuring may be used to take the place of more expensive fertilizers. It is in this latter use that it finds its widest application." In attempting to explain how the fertility of the soil is maintained by green manuring, when the crops plowed under return to the soil only what they exhausted from the soil to produce their growth, the author of the bulletin, Mr. E. W. Allen, says: "The question has been solved by one of the most important discoveries yet made in agricultural science. It has been found

that certain plants can feed upon the nitrogen in the atmosphere and store it up in their tissues. As they grow they take their phosphoric acid and potash from the soil. It is believed that plants are enabled to get this nitrogen through the activity of the lower forms of life, bacteria or microbes. They produce or cause to be produced little nodules or tubercles on the roots. Through these tubercles the plants get their atmospheric nitrogen.

"These discoveries throw a new light on green manuring and on plants best adapted for that purpose. They recommend it more highly than ever before as a soil renovator and a cheap means of maintaining the fertility.

"It will thus be seen that it is possible to manure the soil with nitrogen of the air, which is free and inexhaustible, and thus save buying this most expensive element, which as stated above, costs from 15 to 20 cents per pound, while potash and phosphoric acid cost only 5 to 7 cents and even less."

Speaking of the cow pea as a fertilizer, the same author says: "It responds readily to the application of potash and phosphates. An acre of cow peas at the Louisiana Station yielded 3,970.38 pounds of organic matter, containing 64.95 pounds of nitrogen, 20.39 pounds of phosphoric acid, and 110.56 pounds of potash."

Liquid Manure.

There is perhaps no one thing in farm economy in the United States where there is a greater waste than in regard to this most valuable fertilizer.

Many farmers have brooks running through their barnyards, or have them situated on side hills, washed by rains and water from the roofs of their barns.

The following table shows the number of pounds of nitrogen, phosphoric acid, and potash found in a ton of fresh dung and urine, and their comparative values:

	Dung.				Urine.			
	Nitrogen.	Phos. Acid.	Potash.	Value.	Nitrogen.	Phos. Acid.	Potash.	Value.
Sheep	11.0	6.2	3.0	$2.56	39.0	0.2	45.2	$9.61
Horse	8.8	7.0	7.0	2.30	31.0	....	30.0	7.40
Cow	5.8	3 4	2.0	1.37	11.6	....	9.8	2.71
Swine	12.0	8.2	5.2	2.93	8.6	1.4	16.6	2.44

The analysis from which the above table is computed is also from Professor Wolff, to which I have added the value as estimated in the previous tables. The methods used to save liquid manure in this country, although rarely ever practised, are by absorbents behind the stock in stalls, and the housing of manure under some kind of shed or basement. My own plan has been to use land plaster freely in the gutters behind the stock, the manure carted to the fields and spread as fast as made during the winter,

or spread about under the basement and straw stack which stands on posts, permitting the stock to run under it, the yard being deeper under the stack than elsewhere, with eaves-troughs so arranged that all water from the roofs was carried out of the yard.

In foreign countries, and especially on the islands of Jersey and Guernsey, every farmer has a liquid manure cistern, and over or near it all the manure of the stable is daily piled or composted. The drain from the pile and the wash of the yard is collected in this cistern, and from there pumped into carts for this purpose, and distributed usually on the meadows. The Jersey and Guernsey farmers are the best agriculturists in the world, and they would as soon think of going without a stable for their cattle as without a liquid manure cistern. I think we make a great mistake in this country in not having such cisterns.

In applying liquid manure, it is always greatly diluted by allowing the eaves of the barn to run in the same cistern, or water is otherwise added. Where they obtain several cuttings of lucern for instance, a dressing of liquid manure is put on after each cutting, and the results are something magical. A man with one horse cart, it is claimed, can pump and deliver to the field, if within a quarter of a mile of the barn, dressing for an acre. I doubt if one man could deliver and spread more than one-half of that amount of solid manure in a day. Where windmills are used, they may be used to do the pumping, having two carts, one being pumped full while the

other is being emptied. Should the cart be filled before the drivers return, and run over, it runs back into the well. I do not think of any one thing in farm economy where there is a greater chance for saving than in this one question of liquid manure. I believe it will pay a better return on the investment than any one thing that can be recommended.

The German proprietor of eight acres, referred to by James Wilson, in "Ten Acres Enough," who transformed the neglected and exhausted soil into a garden of immense productiveness and great profit, started with a capital of $3 and four pigs. The manure of this small number of stock was collected in a buried hogshead, there reduced to liquid manure, and applied by means of a wheelbarrow. The results from this small beginning were so remarkable that he soon added more stock, sinking a brick cistern in the barnyard, into which the liquid manure from the cow and two horses was conducted, together with the wash from the pig pen and yard. The manure heap, always under cover, was thoroughly saturated by means of a pump in the cistern, and by means of a hogshead on wheels the liquid was distributed over the ground.

The reason why liquid manure cisterns are not common in this country is simply fashion. I believe it is not too much to say that we waste as much every year by not securing the liquid manure as we pay for commercial fertilizers to take its place.

Saving Manure (Plaster).

We are told that "during the fermenting process in the manure heap, carbon dioxide gas is given off, and likewise ammonia, simultaneously with the decomposition of the materials constituting the heap. These two substances will at once combine to form carbonate of ammonia, which is very volatile. Now, when land plaster is added, the carbon dioxide contained in the carbon of ammonia will unite with the lime composing the plaster, forming carbonate of lime: and the sulphuric acid which was previously combined with the lime in the plaster will now be set free, and will at once unite with the ammonia contained in the carbonate to form sulphate of ammonia, which will not volatilize, as was the case with the carbonate."

Commercial Fertilizer.

Our alphabet is composed of twenty-six letters or characters, which we arrange so as to express thousands of words. The botanical alphabet is composed of fifteen letters or elements, which, being put together in various forms, produce every known plant.

Most of our artificial manures are special fertilizers and supply the soil with only part of the plant food required. Let us suppose, for example, that we wish a certain field to produce a crop of wheat, and that in order to grow that crop it will require five of

the fifteen elements that constitute the vegetable alphabet; to spell wheat, let us represent these five elements by five letters of our alphabet, as W, H, E, A, T.

If any one of these letters or the elements which they represent are missing in the soil, the combination is incomplete, nature fails to spell the word, and our crop is a failure.

How is a farmer to know which one of the letters is missing? By analyzing the soil. Yes, but how many farmers are in a position to do this? Besides, it must be done not only with each succeeding crop, but in different fields for the same crop. You say this is impossible. Certainly it is. Even if it were possible, the analysis of a soil is little or no criterion as to its ability to produce a crop. It may show by analysis that a certain soil is abundantly supplied with all the elements necessary to produce a crop of wheat, and still the land be unable to grow wheat, because, although the soil contains all the elements, one or more of them (though in great quantities) may be in an insoluble state, so that they are not available to the plants. Therefore, even if analyzing the soil were practicable, it does not tell what we want to know.

The application of complete fertilizers is a step in advance, because if the soil is supplied with all the elements necessary to produce a crop, one is more certain that the missing or deficient letter or element will be supplied.

We will say in the case of growing a crop of wheat

that all the letters or elements are present and available except T, and that that letter represents potash which can be bought in various forms for about 4 cents a pound. The soil being already abundant in all other elements, the application of a complete fertilizer is a most extravagant practice. You pay $30 to $40 per ton for a high-class complete fertilizer. Apply it to the land in this case, and all the value it has is the potash it contains, worth $4. Paying $35 a ton to get $4 worth of fertilizer is a rather expensive luxury, to say the least. The nitrogen and phosphoric acid are practically wasted, because the soil has an abundance of these two elements already.

Thus it often occurs that the application of a little lime or land plaster, salt or wood ashes, produces equally as good results side by side with fertilizer costing $60 per ton. It is not because, as some farmers suppose, that commercial fertilizers are worthless, but because the soil already possesses all the elements contained in the fertilizer except some simple one that a much cheaper element can supply.

I do not condemn commercial fertilizers, but they are too expensive. I have experimented with them several times, and have never but once or twice obtained sufficient additional returns to justify the outlay. I look at them as too much of a lottery, too much guesswork. In a cold, backward season, I have had good results; in a hot, dry season, a positive damage.

If I knew just what each of my fields was deficient in, and could supply it without buying a lot of other

elements of which my soil has already an abundance, it would be different. But I do not know that, and have no way of finding it out with any degree of certainty. Therefore I shun the purchase of commercial fertilizers, and put my faith in barnyard manure, which I know, as Professor Atwater says, is a *complete fertilizer*, and I believe him when he adds, as already quoted: "It improves the texture of the soil, it tends to regulate the supply of moisture, it helps to set free the stores of inherent plant food which every soil contains."

Next to barnyard manure in point of economy is green manuring, especially when the former is scarce and must be hauled to any great distance. Commercial fertilizers are too expensive for their manurial value, as compared with grain and forage crops plowed under or fed to stock.

You may take the analysis of any brand of fertilizer selling at $30, go through the table of comparative values, and pick out a grain or a forage containing as high a percentage of nitrogen, phosphoric acid, and potash, that you can buy in the markets for $15 to $20, or which you could grow for less than a quarter of that sum: two tons of clover hay, for instance, that can be bought for, say, $10 per ton, and grown for less than half of that amount, contain nearly as much plant food as a ton of commercial fertilizer that will cost $30.

If a ton of fertilizer that contains 45 pounds of nitrogen, 200 pounds of phosphoric acid, and 90 pounds of potash (which is about the average anal-

ysis) is worth $30 (which is about the average price of fertilizers of that grade), then a ton of clover hay is worth nearly $15, a ton of wheat bran about $16, a ton of oil cake $30, while a ton of cotton-seed meal contains as much plant food, ton for ton, as a $30 fertilizer, and can be bought for $6 per ton less. That is their value, or what you would have to pay for the same amount of plant food if bought in the form of commercial fertilizers, to say nothing about the value of the grains and forage crops as a food for stock. Say nothing about the increased value of plant food as supplied in barnyard manure above any form of commercial fertilizer. Put it the other way about.

If a ton of clover hay contains plant food to the value of $9.78, wheat bran $12.28, oil cake $20.40, cotton-seed meal $23, then a ton of commercial fertilizer that sells for $30 is worth only about $23; a ton of fertilizer costing $37, about $30.

If you say that I have put the value of commercial fertilizer too low, then all values set down in the tables are too low. If, on the other hand, you say that the forage and feed have been given too high a value as manure, then commercial fertilizers have also been given too high a value. They are both figured on the same basis.

Selling grain to buy fertilizer seems to me such an extravagant way.

When we pay $30 for a ton of commercial fertilizer, the money goes off the farm. When we grow an equal amount of plant food and retain it on the farm, we

double its value. Nothing has gone off. We have, on the other hand, created or made that much money.

The amount spent in this State (New York) yearly for commercial fertilizers is over $6,000,000, the interest on which would pay for the extra labor of soiling every cow in the State, or building a liquid manure cistern on every farm, the saving of which would perhaps equal the amount paid for commercial fertilizers. To the farmer who would enrich his farm in a sure and economical way, and to the farmer who puts his faith in barnyard manure and would attain the greatest possible amount at the least possible cost, the soiling system, as we shall presently show, affords just those conditions and advantages.

Oil Cake and Cotton-seed Meal.

Before closing this chapter on manures, I wish to call the reader's attention to a by-product, that in this country at least is in no way appreciated. I refer to oil cake.

You will notice by the foregoing tables that oil cake is worth $37.24 as a food, and $20.40 as a fertilizer, while corn meal is only worth $24.48 as a food, and $7.16 as a fertilizer. In other words, it will take a ton and a half of corn to equal the feeding value of a ton of oil meal, and three tons of corn meal to equal the oil meal as a fertilizer. There is a small percentage of plant food lost in the consumption of food by cattle. Its combined value

per ton as a food and fertilizer is, therefore, oil meal $57.64, corn meal $31.64, a difference of $26 a ton in favor of oil meal. The English farmer who knows and appreciates the value of oil cake is buying ninety per cent. of the total that is manufactured in this country, paying freight on it to our seaboard, and then across the Atlantic and into the interior. Thousands of tons per month leave this country for foreign ports.

This is no speculation on my part; oil cake or oil meal is one of the very best of foods. Why it is so slow in finding favor with American farmers, I cannot say. As a food for fattening sheep or beef, corn meal is no comparison. It produces the finest flavored mutton, the tenderest beef with the greatest amount of lean in proportion to the amount of fat, and it makes meat instead of grease. A field of turnips fed off to sheep with a ration of oil cake enriches the land for a whole rotation of crops. It cannot obtain much from the roots, for they are ninety per cent. water to start with. Any one who has ever tasted English oil-cake-fed mutton will agree with me that it is as much superior to corn-fed mutton as is possible to imagine.

Oil cake may seem expensive at $28 to $30 per ton, but it is the cheapest fertilizer you can buy. Cotton-seed meal is another by-product, although it is not to be compared with oil cake as a food, because it is not relished as well by the stock, and if fed in too large quantities sometimes produces injurious effects. However, it is a good wholesome

feed, and as a fertilizer none can compare with it. It should be fed sparingly, but nevertheless should be used on every farm. Sell corn and buy oil meal or oil cake, and you will make a good bargain every time.

CHAPTER III.

OUR ANIMALS.

How to Feed Them Economically.

Now that we have considered our soil and its fertility, our plants, and how to feed them economically, we will have a look at our animals. Then we shall be better able to understand and appreciate the advantages of soiling. These are some of the principal lessons that the soiling system teaches. These lessons were taught me by a force of circumstances against which I fought desperately, and were learned from the end backward. I have, therefore, in this plea for soiling, reversed the order with the hope of leading the reader up to the subject from the foundation.

As the quantity and quality of the forage depends upon the fertility of the soil, in like manner does the condition of our farm stock depend upon the quantity and quality of the food which the soil produces.

The Cow as a Machine.

A cow is but a machine for the production of beef, milk, cheese, or butter. Sheep are but factories on a small scale, for the production of wool or mutton. The horse is but an engine for motive power, either draught or speed.

When we come to consider our plants as depending upon us, like our animals, for their food supply: when we come to consider our animals as so many machines or factories, and ourselves as the proprietors of so many mills, and as truly a manufacturer as the man who runs a cotton or grist mill: when we consider that all these mills are dependent upon the fertility of the soil, we have mastered the fundamental principles of farming. Whether we require of our animals beef, milk, butter, cheese, wool, mutton, or motive power, the raw material from which these things are produced is simply the food these animals consume, and, as in any other mill or factory, the profit realized by the owner is what these animals can be induced to consume beyond the amount required to sustain life, and heat the blood, and supply waste.

An engine requires, say, ten pounds of coal per hour to produce power enough to sustain itself in motion. The profit to the owner will be found in the amount of coal it can be made to consume in excess of the ten pounds to a point where the consumption of coal cannot be utilized in the engine. Repeated experiments at home and abroad have demonstrated that it takes two per cent. of the live weight of cattle or sheep per day to live. A cow, for instance, weighing 1,000 pounds requires twenty pounds of hay or its equivalent to heat the blood and supply the waste. The profit or economy in feeding that cow will be, therefore, as in the case of the steam engine, found in the amount she is able

to digest and assimilate above the twenty pounds she must consume to propel herself. Of course, cattle, sheep, and horses, like the engine, have a limit beyond which it is a waste of material, to say nothing of the injurious effects and risk to the machinery. Fuel fed to an engine already blowing off steam might better have been consumed in a bonfire. Forage in excess of what an animal can digest and assimilate might better go into the dung-hill direct.

The art, and science, and economy of feeding, therefore, is to feed up to an animal's fullest capacity.

This seems like a very simple question, and one that should be so self-evident that it requires no mention, but when we look about and see the thousands and tens of thousands of farmers whose policy seems to be to see how little they can feed, instead of how much, one is reminded that it is a point that is seldom practised. Just here lies the great advantage of the soiling system. It provides, as we shall presently show, an abundance of rich succulent food, so that a cow can feed up to her full capacity every day of the year.

When Insufficiently Fed.

It is not only absolutely necessary, in order to feed a cow economically, which is another name for feeding abundantly, that she should be fed up to her fullest capacity, but she must begin there and keep there. If she is not started there, it is not only difficult but more expensive to get her there. She

should not only have all the raw material she can consume and digest, but she must expend the least amount of muscular labor to acquire it consistent with health. We shall notice this point further under "Objections to Soiling."

When animals begin the season in good flesh, it must be maintained by abundance of food. Failing to supply it, either one of two things happens. They either stop short in their product, or draw on the stored energies of the system, which are, as R. S. Thomson says in "Science of Farming," "reabsorbed into the blood and burned in the place of food. If the deficiency of food continues, the muscular substances will also be attacked and absorbed. This process will continue until the animal can no longer obtain from its tissues material to produce by its combustion sufficient heat and energy to maintain the vital processes, and the animal dies." Another great difficulty in the pasturing system is, the animals, cows in milk especially, begin to draw on their stored materials long before it is usually noticed. They go on giving a good flow of milk on pasture which is insufficient to sustain them, until the first thing the owner knows his cow is a skeleton, and to get her back again will require the cost of all she has hitherto produced. Getting a cow up into condition which has once been lost, while she is milking, is a very long, stern chase, and a very expensive undertaking, as any one knows who has tried it. Better dry her off and begin again next year, and not only have her up at the beginning, but keep

her up through the year. In order to accomplish this at the least possible expense, the soiling system, which provides an abundance of rich, succulent food the year round, will be found to meet every requirement.

In feeding farm stock, it is the liberal hand that maketh rich. Withholding will not enrich nor giving impoverish. With this hypothesis, the soiling system is in perfect harmony.

Looking at a cow as a machine, and a sheep as a wool factory, we see the importance of not only feeding liberally, if we would be economical, but of providing the animals with food so that they are put to the least wear and tear to obtain it. The food which is consumed by a cow to replace and replenish the wasted tissues caused by laboring all day to collect her food, is by the soiling system put to a practical advantage and a profitable one as well. I shall be able to illustrate this point more fully further on under the chapter devoted to soiling sheep.

The rearing of calves for dairy purposes is a subject to which I have given much attention, and although I cannot enter into the details or give anything like a complete treatise on that subject here, I may say that for supplying growing calves with an abundance of rich, succulent forage at a time of life when they require the highest development of those organs which constitute the machinery of a dairy cow, there is no system of feeding to accomplish this end like a well-conducted feeding of green forage to them in their stalls.

CHAPTER IV.

SOILING.

My First Lesson in Agriculture.

In 1874 I found myself in possession of an old farm in Wayne County; it seemed as if I had secured a prize. I had lived on this farm until I was ten or twelve years of age, and after that spent most of my school vacations upon it. This was in the sixties, when agriculture was booming and such land was worth $150 per acre. In those days, this particular farm enjoyed the reputation of being one of the very best in the county.

After taking possession of the farm some ten or twelve years later, I was greatly surprised at the change that had taken place, not only in the general run-down appearance of the place (which was not to be wondered at on a farm that had been worked on shares for fifty years), but in the matter of the farm's ability to produce.

I discovered that the number of cattle that it once maintained in such prime condition had been reduced by half, and that the flock of sheep which was once the pride of the former owner had disappeared entirely. My disappointment reached its climax, however, when my first wheat crop from a field

considered one of the best on the farm was a failure. As a lad I had driven the old Wood and Manny reaper in this same field in grain so heavy that I was often obliged to stop the machine to enable the man who "sat standing" on the platform to fork it off, as it came on the table faster than he was able to dispose of it, and at the rate of about forty bushels per acre. Of course, I expected, from my former knowledge of the farm, to get good crops from all of the fields, and from this particular field something extra. Imagine my surprise and disappointment when it produced but fifteen bushels of wheat per acre, and wheat of inferior quality at that. This revelation was more than discouraging. Like most people, I have met with many disappointments and much heavier losses since then, seen fondest hopes and most substantial looking air castles fade away like mist, but I was young then, just past my teens, and I took this disappointment very much to heart. Such a wreckage as seemed to fall about me that day, I have never since experienced. The situation figured out with the following result:

STATEMENT SHOWING THE COST AND THE PROFIT AND LOSS OF GROWING FIFTEEN AND FORTY BUSHELS OF WHEAT PER ACRE.

	Fifteen Bushels.		Forty Bushels.	
	Dr.	Cr.	Dr.	Cr.
To fitting the ground.....	$5.00		$5.00	
To two bushels seed at $1.10 per bushel.....	2.20		2.20	
To interest at seven per cent on one acre.....	8.75		8.75	

	Fifteen Bushels.		Forty Bushels.	
	Dr.	Cr.	Dr.	Cr.
To harvesting and drawing to barn .	1.75		2.00	
To threshing, etc., at six cents per bushel	.90		2.40	
To marketing, one and one-half cents per bushel.....	.22		.60	
By cash for wheat at $1.10 per bushel		$16.50		$44.00
Total	$18.82	$16.50	$20.95	$44.00
Balance	16.50			20.95
Loss per acre	$2.32			
Gain per acre				$23.05

There were sixteen acres in the field. This made a total loss of $27.12, while there would have been a net gain of $368.80 had the field produced forty bushels per acre, which it ought to have done. The difference per acre in cost of growing forty bushels over a yield of fifteen bushels is only $2.13 per acre, while the difference in income would have been $27.50 per acre. But this $2.13 does not begin to represent the actual loss; saying nothing about all that labor being thrown away, the wasted plant food that was in the soil that must be returned, and the wear and tear of team and tools, etc. The seeding as may be expected failed to catch, and this was by far the greatest loss of all, a loss that no arithmetic can figure out. There was the loss of the timothy seed sown the fall before, and the clover sown in the spring, and the labor of putting it on (no very small items). But the further damage to the land itself, which, as I said before, is incalculable,

would undoubtedly have all been avoided had the land been in a higher state of cultivation. It is a case of "To him that hath shall be given, and from him that hath not shall be taken away even that which he hath."

Sad and disappointing as was the above result, I have long since looked back upon it as a most fortunate occurrence, and one of the best lessons in practical agriculture that I ever received.

From the day I made those disappointing figures dated a complete change in my notions and methods of farming. I had absorbed all I knew about farming, as a lad, while living on and visiting the old place.

What had become of the old farm that was once known as one of the best in the county? The sun shone as brightly as ever upon it, nor were the clouds less generous or the dews less refreshing. The seasons also came in their usual rounds the same as of old. The land was all there, but what had become of the old farm? It had gone, for I soon discovered that my other crops were in proportion to my wheat crop. I was not able to figure out anything but a loss all the way through.

The old farm as I knew it had disappeared; its fields were as beautiful, its meadows as peaceful, its woodland as delightful, its brook as charming, and its shady lane as inviting as ever, but the old farm had gone. It had been sold by the pound, by the bushel, and by the ton, peddled out along the wharves of the metropolis, sent away to foreign mar-

kets, and finally washed into the sea, and this is how it happened that, as I said in the beginning, "the number of cattle had been reduced by half, and the flock of sheep had disappeared entirely."

"And is this what they call farming?" I asked myself. "Is this the most independent life that a man can lead?" It seemed to me that this sort of thing was mere drudgery, and of all things the most dependent life a man could lead. I was simply working for my board and clothes, and running in debt for the latter on a farm of 127 acres, worth at that time $125 an acre, representing an investment of $15,875. "Is this the most healthful occupation a man can lead?" It looked to me to be a short cut to a premature grave. Was this the calling that all other men envied, and the source of wealth? It looked to me as if selling peanuts on the street corner at a profit was much more enjoyable.

It seemed to me as if there was more independence in a ten-acre clearing full of stumps where wheat could be grown at a profit, than in a 127-acre farm where it was grown at a loss.

In making this general survey of the situation, I came to the conclusion that the only way of redeeming the fertility of the soil was the proper application of barnyard manure. Commercial fertilizers were not the fashion at that time; even if they had been, their purchase was hardly to be considered, for some of my neighbors who had tried them in gravelly soil said that they did not pay. The farm was four miles from town, so that the purchase of stable manure was

out of the question. But there was no use going on without manure. Here came the rub. How was I to increase my stock when the few head I already had were not more than half fed?

My faith from the first was in barnyard manure, but how to get it, that was the question. I drifted along through the first winter into the next summer, when presently I found the solution of the whole question worked out on my own place for me, and in a way I least expected. The answer to the problem was, "Soiling." I was forced into it against my will. I at first fought desperately, but soiling came out ahead, as will be seen in the next chapter. I give this personal experience so that if the reader is one who finds himself in a similar predicament (and I know thousands of my fellow farmers are or are very near it), they may take heart and find some relief in the same direction, and, instead of rebelling against the way in which fate seems to be leading them, turn squarely about and go the way she points. I give this experience also for the benefit of the farmer whose faith is in barnyard manure instead of in commercial fertilizer. He will see, as perhaps no other can, how his fondest hopes may be more than realized, *i.e.*, how he can manufacture five times as much barnyard manure as formerly and keep the same amount of ground under cultivation for marketable crops. How he can always be sure, beyond any doubt, that he is returning to the soil yearly more plant food than he is taking from it, which means an increased fertility of the soil;

which means larger crops; which means more profit; which means more books and papers, a better seat in the cars, at church, and at the theatre; better clothes, more recreation for himself, and a higher social position for his family.

In a word it puts the man on the road to independence, and shows that a farmer's life after all is not the most dependent life a man can lead; and that in spite of the foreigners the Government keeps setting up in the farming business, in spite of being smothered by over-production, he may still pursue farming with the respect to himself and family that men of other professions enjoy, where an equal amount of capital is invested.

How I Happened to Adopt Soiling.

As I was saying in the last chapter, I drifted along until the following summer. I was very much discouraged. I saw no hope for anything better. I tried to make myself believe that the year before had been a bad season, an excuse that thousands and tens of thousands of farmers are yearly making as an apology for poor crops; the worst of it is that they seem to succeed in making themselves believe it. But I have long since noticed that a season too wet or a season too dry affects principally men who have farms like mine, farms that have been robbed of their fertility. It is usually an apology for not knowing how to farm; shifting it onto the weather is the easiest thing in the world, but although I tried to work that excuse on myself, somehow it failed.

Finally, it came about the middle or last of June, and my cattle began to get unruly. (I only had six head—think of only six cows and five horses on 100 acres of tillable land! No wonder the fertility of the old farm had gone.)

The old tumbled-down fences were no hindrance to the natural taste for adventure and desire to roam, which became magnified as the condition of the pasture diminished, and the spirit that entered the swine, or some that was left over, seemed to fill them in proportion as their stomachs became empty. They went wild themselves, and drove all hands nearly crazy. It was just at a time of year when farm work was driving, and, therefore, no time to build fences.

In fact, after a week or two of schooling over the old fences surrounding the pasture, nothing was too high for them to get over. My cows, every one of them, were so proficient in jumping that they were fit to ride across any country to hounds, and as to speed, any farm lad knows how a steer can run through the corn. I remember driving them out of the corn myself one day, and having them jump back again in another place while I was patching up the first breach.

If there could only have been a precipice where they could have run violently down into the sea and all have been drowned, I should have been a most happy spectator.

The sleepless nights, the worry, the anxiety, the miserable fences that could not be fixed were all

more exhausting than a hard day's work after the plow or in the harvest field, and that had to be done besides. One day I was called from home, and when I returned, I asked my man if he had finished a certain piece of work I was particularly anxious to have accomplished that day. "No, sir. The cattle got out, and it took me nearly all the forenoon to get them back again and mend the fence." "Did you deliver the butter to the station this afternoon, as I told you?" "No, sir. Just as I was starting for the station, the cattle broke out again, and before I could get them back it was too late to get to the train." That was the last straw. He told how he had chased the unruly brutes through the corn, in language that cannot be printed.

I was pleased, however, to hear him express my own sentiments so forcibly. "I can't stay here, sir, if this thing goes on much longer." "I don't blame you, Pat," I replied. "I have a notion to quit myself, but I can't spare you. There would be no one here to speak of the brutes as they deserve if you should go. Shut them in the barnyard at once, and feed them hay until we can cut some clover. We will rig up the mower and feed them green clover in the barnyard. They will not jump that eight-foot barnyard fence, will they, do you think?" "Sure, you will have to lock up the ladder," said Pat, whose ready tongue never forsook him, "or they will be climbing over it." Thus we began soiling.

For a few days the cows were restless and home-

sick, and evidently pining for a gallop through the corn, but when we began feeding them green clover and they were thoroughly filled they became reconciled and peaceable.

There is nothing like a full stomach to make a cow the most quiet and contented animal on the farm. The discontent they manifested the first week or so made me sorry for them, and if there had been a place to turn them, they would, no doubt, have gone out of the yard, and thus would have ended my experience in soiling. Fortunately there was no such place. At first we began feeding them in open racks in the barnyard, but this proved a failure. One boss cow would master the whole rack and succeeded in nearly goring a heifer. Again I was wishing I could turn them out. There was only one alternative, *i.e.*, to fasten them in their winter stalls and feed them there. This we did, turning them out nights. I took care not to let my neighbors know about this, for I knew they would laugh at me. Such a thing had never been heard of in that vicinity.

Let me say right here, that I believe it is at this point that many a man who has tried soiling has failed or became discouraged. They have attempted partial soiling, when they have experienced all the inconveniences and only a small part of the benefits, and this is the case with everything else that is half done. As soon as we put the cattle in the barn, and tied them in their stalls, they began to gain wonderfully in flow of milk and to thrive be-

yond all expectation. I was surprised also at the very small amount of ground required daily to support them handsomely, and I was still more surprised to find that the extra labor required to feed the cows and cut the clover in this manner was nothing like what I had imagined it would be, and then it dawned upon me that I might do this way all summer. Why not keep twelve cows instead of six? Make twice as much manure, and manure twice as good in quality, which amounts to four times as much. That's the thing to do, and the greatest load I ever attempted to carry in the form of a business enterprise was saddled onto soiling, and I found soiling quite able to carry it and much more besides. Thus began what proved to be the most successful and most economical method of feeding farm stock. Thus I found a solution to the question, How to enrich the farm in a sure and economical way; how to supply the farm stock with the most nutrious food at the least cost; how to obtain a full flow of milk from our cows during the entire season, independently of parched pastures; how to increase the number of farm stock and the acreage of the farm without buying more land.

CHAPTER V.

ADVANTAGES OF SOILING.

The advantages of soiling over pasturing are numerous. The principal reasons for its adoption may be found under the following headings: 1st. Saving the land. 2d. Saving of fences. 3d. Saving of food. 4th. The better condition and greater comfort of farm animals. 5th. The greater production of beef, milk, wool, or mutton. 6th. The increased quantity and quality of barnyard manure. 7th. The increased fertility of the soil. 8th. The increased acreage of the farm.

The disadvantage of the system as compared with pasturing is extra labor.

The Saving of Land.

Says the Hon. Josiah Quincy, whose experience in soiling covered a period of eighteen years: "One acre soiled from will produce as much as three acres pastured in the usual way, and there is no proposition in nature more true than that any good farmer may maintain upon thirty acres of land twenty head of cattle the year round." He adds: "My own experience has always been less than this, having exceeded seventeen acres for twenty head."

Mr. Henry Stewart, of New York, says: "I have

kept the same amount of stock by soiling on seventeen acres that I previously kept on fifty acres."

By soiling, D. J. Powell, of Winchester, keeps 100 cows on 100 acres, and he adds that "with complete soiling I have kept fourteen cows on eleven acres the year around, with the help of a few loads of brewer's grains and some bran and meal."

Where land is in a high state of cultivation some farmers claim to keep as many as seven and eight head by soiling where they were able to keep but one by pasturing. I think, as a rule, it is safe to say that, whatever land is required to support a full-grown animal during the pasturing season, the same land will support five or six head by soiling. My own experience has been even better than this. My farm at Maple Lane contained just about 100 acres of land inside the fences, after taking out roads, lanes, buildings, and woodland. On this 100-acre farm, before adopting soiling, I was only able to support twelve head of stock, which required of hay and pasture sixty acres per year, or five acres per head, which I find is about the usual amount throughout the country on good and fairly productive farms. This left forty acres for marketable crops.

After adopting the soiling system, the number of farm stock increased until I had thirteen age cows, five yearlings, four calves, four horses, two colts, and seventy long-wooled (Cotswold) sheep. Estimating 1,000 lb. for a full-grown animal, this was equivalent to thirty-six head. These thirty-six

head were supported from the product of thirty acres of land. This was the average for three years. This left me seventy acres for marketable crops. It will be seen that while I was keeping three times as much stock as formerly, I did so on just half the land, and at the same time nearly doubled the acreage of marketable crops. What does this mean? It means that thirty-six head at hay and pasture would have required 180 acres. The capacity of my farm was, therefore, increased from sixty to 180, an increase of 120 acres. The acreage of my farm for marketable crops was increased from forty to seventy, an increase of thirty acres, or a total increase of 150 acres without buying a rod of land. So much for the saving of land. In other words, any 100-acre farm that will support twenty head of cattle by hay and pasture (and that's about all it will do unless it is in a very high state of cultivation), that same farm by soiling will support, and in much better condition, 100 head of cattle. So far as soiling alone is concerned, if you were to buy a farm to support 100 head of cattle, and your method was hay and pasture, you would require at least 500 acres, to say nothing about grain. Whereas, if you adopt a strict soiling system, as hereafter described, you would be required to buy only 100 acres, a saving of 400 acres. Is this not worth an effort? Can you not afford a little extra labor to make a 100-acre farm support 100 head of cattle instead of twenty? We shall discuss this point further under the head of extra labor. It may be asked,

"How can a farm support such a heavy cropping?" You will notice that where I had not quite doubled my acreage for marketable crops, I had three head of cattle for every one formerly kept. Nor was this all. My stock was not only producing three times as much barnyard manure in quantity, but its quality, especially during the summer months, was at least doubled compared to what it would have been if made at pasture, where it is mostly destroyed by bugs and worms, or makes a rank growth where it drops, which all cattle shun for a year to come, and will only eat of it when absolute hunger compels them. There is another item of saving of land. All the land occupied by inside fences may be saved and turned to producing crops instead of being a yearly expense.

Here is a sample of how the soiling system works, and may be demonstrated by any one who has the courage to try. May 1, 1880, we turned twelve milch cows to pasture in a field containing four and one-half acres. At the end of the fourth week we were obliged to take them out, as they were getting very thin and shrinking badly in flow of milk. The pasture was exhausted. They were turned into the sheep pasture until June 7th, when we began soiling them, and the same twelve head were supported with all they could possibly consume for the next four months from the product of four acres, making one acre soiled from equal to four pastured, while the condition and comfort of the stock was so much better, and their yields so much greater, that there was

really no comparison between the two systems. The value of the four acres pastured at 50 cents per week per head would be $24, while the four acres soiled at the same rate gave a feeding value of $96, a difference in favor of soiling in the saving of land of $72. While this question of the saving of land is being discussed, it is to be emphasized that in this particular lies the great advantage of soiling and ensilage over pasturage and hay. Experimental stations figure and analyze and show green crops but little better than hay and ensilage, but little better than cured forage, and they go into hair-splitting discussions on this line, forgetting that the great undeniable advantage that soiling and ensilage have over pasture and hay is that the soiling system enables the farmer to increase his acreage without buying more land. This work will not enter at all into the difference in feeding value of green and cured forage. The soiling system gives the farmer such an enormous gain in the saving of land that all other questions are small and insignificant in comparison.

Particular stress is laid on this point, because it is so often lost sight of in discussing this question, especially by experimental stations. To repeat, if there was not another single advantage of soiling summer and winter over the usual way for feeding, this question of saving of lands is so great and undeniable that the reader need not look beyond it. However, there are other advantages which may be discussed, and several of them are quite enough in themselves to warrant adopting

the system, but the one grand object is and always must be the saving of land or the increased acreage of the farm.

Saving of Fences.

In some sections of the old countries where the soiling system is generally practised, the farmers have done away with interior and boundary fences, setting landmarks to indicate lines, and thereby working every foot of land. Says Mr. A. W. Cheever, in "The Country Gentleman": "Another great advantage I find in soiling over pasturing is the saving of fences. None of my mowing or cultivated fields are pastured at all, so that I have been enabled to dispense with all inside fences, and lately have been giving up the use of road fencing also."

No farmer will disagree with me in saying that farm fences are great nuisances, harbors for rats, mice, and vermin, most convenient places for noxious weeds and grasses, and great hindrances in every stage of farm work. For instance, if we wish to cultivate two fields adjoining each other but separated by a fence, we must stop and turn about as we approach the fence from either side in plowing, harrowing, cultivating, rolling, drilling, reaping, and raking. Thus in growing a crop of corn, with a fence forty rods long it would require about 1,500 or 1,600 turnings, and for wheat 1,200 or 1,400, according to the mode of culture. All this wastes time, besides trampling down the ground and crops. As Mr. Quincy says, "The whole farm may

be divided and cultivated with precise reference to the state of the soil, when the plow runs the length of the furrow determined by the judgment of the proprietor." His farm at one time had five miles of interior fence (equal to 1,600 rods), of which he says, "I have not now one rod of interior fence; of course, the saving is great, distinct, and undeniable." My own farm was at one time divided into seventeen fields, which required over 1,000 rods of interior fence, the interest on the cost of which would pay the taxes on the entire property, or pay for all extra labor of soiling twelve or fourteen head of stock, to say nothing of the cost of yearly repairs. I built some 300 rods of fence soon after coming on the farm. It hardly made a showing compared to what was needed. It would have required an outlay of $1,000 to put all the fences in proper shape, and for what? Simply to keep twelve head of stock from destroying the crops. Each field must be fenced, for, by the rotation of crops, each field was in turn pastured.

Reader, if you are a farmer, don't build another rod of fence until you have given the soiling system a fair trial and find it a failure. Says D. S. Curtis on the cost of fencing, in the Agricultural Report of 1859: "The most ordinary plain board fences cost 8 to 10 shillings per rod, and more in many places, while rail fences are often still more costly. But taking the lowest estimate, $1 per rod, the expense of enclosing an eighty-acre lot would be $480; two cross fences, one each way, throwing the lot into

four twenty-acre fields, would cost $240 more, a larger sum than the value of the land in many localities." As Mr. A. E. Stewart says, "Soiling effectually settles the fence question."

Saving of Food.

The great trouble with cows or any stock at pasture is that they soon find certain sweet grasses that particularly suit their taste, and to obtain these they tramp, tramp, tramp. Notice a lot of cows turned into a field of clover or grass. They drop their heads as soon as they are through the gate, and for a few moments they eat it as it comes. As soon as their keenest hunger is satisfied away they go. A cow sees another cow eating quietly in a certain spot, and she starts over there thinking she has something good. They finally find certain small patches in any field where the feed is very sweet. This they cut down close to the ground, and it is these sweets that destroy their taste for anything else. It is like turning a lot of children loose in a bake shop and confectionery store. At first they can eat ordinary bread and butter, but presently they throw it away for cookies, after that they throw away cookies for candy, and, finally, they are always hunting for candy and cookies. That is a fair comparison to a lot of cows turned into a good pasture and allowed to help themselves. Nothing tastes good to them but the very sweetest grasses, and they actually go hungry in the midst of plenty

and tramp, tramp, tramp, in search of sweets. If you go into the same field and cut it as it comes, with a scythe, and feed it to them in the barn, they eat the good, the better, and the best, weeds and all, and do well on it. To find that best and sweetest mouthful, they have trampled as much as they will eat. They have wasted a lot of energy that might have been put to a better and more profitable use, seeking it; gone hungry, or next thing to it, because they could not find enough to fill their stomachs of the best, and come to the barn at night weary and tired. Of all extravagant, wasteful habits, the pasturing system has no equal. Tethering is a great improvement in this respect, if the cattle must go out. Tethering will be discussed more fully later on.

There are several ways in which farm stock destroy their feed while at pasture, by tramping it under foot, by their dung and urine, and by lying on it. The more productive the pasture, the greater the loss. Just how much is wasted by these means, I do not know. Some estimate it at one-third, others at a half. Another item of more or less importance is that it is not so exhaustive of the soil to grow a crop of hay from it as to use it as pasture, especially if the grass of the pasture be closely cropped, thus leaving the soil more exposed to the sun. All these objections are overcome by soiling. The food may be cut at just the proper time, when the leaves and blossoms have reached their full development. It is often noticed that, here and there

in a field, patches of distasteful grasses or noxious weeds are left untouched by the stock, except in case of great hunger, and allowed to go to seed. The seed is scattered about the field and pressed into the soil under the hoofs of the feeding stock. In time the pasture thus becomes only a garden of weeds. This would never occur were the practice of cutting adopted. Mr. Youatt, an English author, says, in his valuable work, "The Complete Grazier": "If a close consumption of plants is the object principally regarded, it is evident that the benefit to be derived from soiling will be very great; for experience has clearly proved that cattle will eat many plants with avidity, if cut and given to them in the barn, which they would never touch while growing in the field."

The Better Condition and Greater Comfort of Farm Stock.

On this question there is no chance whatever for argument. The difference in the condition of cattle soiled and those at pasture is decidedly and positively in favor of soiling.

In the first place, all animals that chew the cud are particularly adapted to the soiling system for several reasons. The very nature of their digestive organs shows that they are best provided for when they can have their feed in abundance and near at hand. Their habit is to collect their food quickly until the first stomach or paunch is full. This first

stomach is used as a basket or receptacle into which they store their food. When full they lie down, and it is then that the feeding proper begins. When a cow or sheep or other ruminating animals are grazing, they are not, as many suppose, in the act of eating. They are simply gathering or collecting their food. The sooner they can do this collecting the better, because they do not like to begin eating until the basket is well filled. Besides, the less time it takes to fill the basket, the more time they have to eat and convert it into the desired product. Again, if they must waste a lot of energy and muscular force carrying themselves about, as they do when required to fill their baskets from a scanty pasture, that wasted energy, which is all at the expense of food, as already shown, might better be employed in producing milk or butter. After the animals have filled this first paunch or basket, their habit, as before stated, is to lie down, and then the feeding properly begins by bringing up, from this first stomach, a cud at a time, which they proceed to masticate thoroughly, after which it is sent to the second stomach, and so on to the third and fourth stomachs, where it becomes digested and assimilated with the blood until the basket is emptied, when the cow is ready to collect it full again. Looking at the cow as a machine it will be seen that when she does not have to seek her food by walking miles for it in the hot sun, annoyed by the flies, etc., she is able to convert the largest amount of feed into the product her owner requires

at the least possible outlay of her strength, and the more basketsful of grass or forage she can make way with in a day the more profitable a machine she must become.

A few years ago, when the Mohawk Valley was the principal dairy section of the State, we are told that it was the custom of the farmers and dairymen to cut down all the shade trees in their fields so that the cows would not be wasting time lying under them, when, as the owners thought, they should be up and at work. They also had boys going about to drive their cattle up when they attempted to lie down. They said truthfully that milk was made from grass, and a cow was a machine, and she must eat so much to supply her own wants. The more she can be induced to eat in a day the greater will be her returns to the owner. But they based their reasoning on a mistaken notion, *i.e.*, that a cow was feeding or eating when she was grazing or collecting her food. While they were perfectly correct in assuming that their cattle were machines, and the owners' profit depended upon the amount of food the animals could be made to consume above what they required to heat their blood and supply their waste, they were entirely wrong in supposing that a cow was serving their best interests by being kept on her feet. The next thing is to provide them with the greatest possible comfort, so that when a cargo is ready for the mill, the mill will be in as perfect running order as possible. That is to say, when the cow lies down and the milling begins, she will have

a comfortable resting-place, clean, dry, and easy. No one would think of starting a factory without first oiling the machinery, and so adjusting its parts that it will run with the greatest possible ease. The tie should be such as will enable her to lie in a perfectly natural position. When you have provided the raw materials and everything is oiled and ready, your cow then is in the best possible position to do business as a profitable member of the farm household. With a well-contented mind and a well-filled stomach, she can work up several times as many cargoes a day as if her time was being spent chasing about the pasture looking for sweets and fighting flies. At any rate, you, as manager and proprietor of the mill, have done your part, and there is no excuse whatever for the cow, and no inclination, you will find, except to do her best and attend strictly to business. Nor is the question of the collection of their food with the least possible labor and a good comfortable place in which to lie down the only thing that adds to the greater comfort and better condition of stock soiled. By keeping them in their stables day-times, they are protected from the enervating heat of the sun. They are also sheltered from storms, secured from jumping into fields of growing grain or fruit orchards. They are protected from drinking muddy, impure water and against thirst. This last is an item that is not, as a rule, given the attention it deserves. Milk is 84¼ per cent. water, and a supply of good fresh water, close at hand, is a very important item, because,

when a cow is turned to pasture, and has to go to a distant part of a field to help herself, she waits until great thirst drives her to it. Finally, when she does go, instead of getting a drink and returning to business, she overloads her stomach with water, and stands about in the stream or pond until absolute hunger drives her out again. So she lives on from day to day, eating only when she is very hungry, and drinking only when thirst becomes excessive. The soiling system, with a good well or spring at the barn, prevents all this annoyance, and is no small matter in adding to the comfort and also to the credit account of the animal.

Lastly, and perhaps most important of all, so far as the animals' comfort is concerned, by a proper system of soiling the cattle are protected from flies, those awful pests that sap their blood and drive them to a state little short of frenzy. How can cattle so tormented be expected to do a good day's work? Living in the best of pastures after the middle of June is simply living to exist. To show skeptical people that cattle preferred being shut up in their stables in fly-time, to roaming at will in pastures, I have turned my cattle out—away they would go with their tails over their backs until the flies got after them, when back they came to their stalls as fast as they went.

If the reader could see the difference in the condition of the cattle soiled and those pastured after the beginning of fly-time, he would see such a con-

trast as would require no farther argument to convince him of its value.

Look at that poor, gaunt cow as she comes from a pasture field after a hard day's work, fighting flies until she is desperate, and sometimes until she has given up in despair, too exhausted to battle longer against them, or attempt to dislodge them as they cluster on her neck and back undisturbed. Notice her shuffling gait and melancholy face, the picture of despondency, her hair standing on end. Turn out into the same barnyard a cow that has been properly soiled in stables darkened to exclude the flies; she is as plump as partridges after wheat harvest. She acts like a school-boy from his books, eyes bright, head erect, step sprightly, hair sleek, stomach full, and ready for a frolic. This is no fancy sketch; indeed, I feel as if I had failed fully to represent the great contrast, as I have often witnessed it. I feel safe in saying that I think that no candid farmer, however prejudiced he may be against stabling his cows in summer, would need any other proof to convince him that, so far as the greater comfort and healthful condition of the stock is concerned, the soiling system affords the most gratifying results, and adds materially to the profits.

Greater Production of Beef, Milk, and Butter.

On this question, there can be but one opinion, *i.e.*, that to produce either beef, milk, or butter, the result will depend upon the amount of food con-

sumed, and the profit will largely depend upon furnishing our stock with an abundance of succulent food during the entire year. To accomplish this independently of parched pastures and drought is not a difficult matter by the practice of soiling.

The following testimony as to the superiority of the system was given by Mr. E. W. Stewart, in an article in "The Country Gentleman": "We shall find the same reasons apply in still greater force, in the slaughter of beef and mutton. Animals intended for slaughter should have different treatment from those whose value depends upon the development of muscle. Those reared for labor need much exercise, as well as appropriate food, for strengthening the bony and muscular system; but those intended for human food need only so much exercise as promotes health and a vigorous appetite. And, as we have seen, soiling gives a greater command over the supply of food at all times, so when properly conducted it must afford a greater certainty of rapid growth. We have easily grown calves on green food fed in the yard, together with skimmed milk, that weighed 700 lb. at ten months old. We have uniformly found this system more favorable to the growth of young animals than pasturing—that less milk or grain in addition is required to produce equal growth. And steers and heifers during the second year will make a steady and uniform growth on the full soiling system, with the liberty of a small lot for exercise. Animals for beef or milk are not grown for muscular exercise. They need most full

feeding, fresh air, and kind attention. The skilful feeder has here an opportunity to observe the wants of each animal, and may always supply them.

"There must be no standing still if a steer is to gain two pounds for every day of its age up to 900 days. German and French beef growers adopt largely a strict soiling system, and produce a higher average weight at a given age, than any pasturing people has attained.

"Soiling also offers the opportunity of doing the principal fattening in warm weather, when not more than seventy-five per cent. of the food is required to make the same gain as in winter. We tested the comparative effect of soiling and pasturing on the same class of animals, by putting five two-year-old steers and heifers, weighing 4,500 lb., into a good pasture, while five of the same age and condition, weighing 4,450 lb., were soiled, with exercise in a small yard, and at the end of four months, while those in pasture had gained 625 lb., the five soiled had gained 750 lb., with nothing but green soiling food, making the two lots equal in kind of food. The pasture, although good and abundant when the experiment began, did not continue throughout equally good on account of dry weather, while the soiling food was given in equal abundance to the end."

Mr. Brown, of Mankle, Scotland, tried the comparative merits of soiling and pasturing in fattening forty-eight steers equally divided. The twenty-four soiled brought £377, and the twenty-four pastured

£342, a difference in favor of soiling of £35, or a profit of over $7 per head, to say nothing of the saving of land and the increase of manure.

In regard to the greater production of milk Mr. Stewart relates the most remarkable test of the two systems, published by Dr. Rhode, of the Eidena Royal Academy of Agriculture of Prussia. It was conducted through seven years of pasturing, and then through seven years of soiling. Mr. Hermann is the experimenter. The pasturing began in 1853, and ended in 1859, the soiling began in 1860, and ended in 1866. From forty to seventy cows were pastured each year, and a separate account kept with each cow. The lowest average per cow is 1,385 qts. in 1855, when seventy cows were kept, and the highest 1,941 qts. in 1859, when forty cows were pastured, and the greatest quantity given by one cow was 2,988 qts. The average increased during the last four years from 1,400 to 1,941 qts. The average for each cow for the whole seven years of pasturing was 1,583 qts. In the soiling experiment twenty-nine to thirty-eight cows were kept, and the lowest average per cow was 2,930 qts. in 1862, and the highest per cow was 4,000 qts. in 1866. The highest quantity given by one cow was 5,110 qts. in 1866. The average per cow for the whole seven years of soiling was 3,442 qts. The yield of the same cow is compared for different years. Cow No. 4 gave in 1860, 3,636 qts.; in 1863, 4,570 qts.; in 1866, 4,960 qts. Cow No. 24 gave in 1860, 3,293 qts.; in 1863, 4,843 qts.; in 1866, 4,800 qts.

Many of these were the same cows in both experiments; and it will seem that the same cow increased from year to year, showing what full feeding will do, and also another important fact, that this full feeding was conducive to health of the cow during the seven years.

Dr. Wright says of soiled cows that they "will, at least, equal, if not surpass, those kept in the usual way, in both quantity and quality of milk, and the dairyman, by adopting this method, finds his profits enhanced nearly one-fourth." An English author says, "The cows used to stall feeding will yield a much greater quantity of milk, and will increase faster in weight when fattening, than those which go into the field."

I have made repeated experiments which satisfied myself in regard to the increase of milk and butter, and with the exception of the first month or two (May and June) I have never failed to get better results from the soiling system. The author of "Ogden Farm Papers," in the "American Agriculturist," has a very interesting article on the subject of soiling, in which he says: "The product of cows will be more in the case of soiling than in the other. In June I was making a very satisfactory amount of butter. So were the pasture men all around me. Now that the drought has (in spite of passing rains) begun to affect the pastures, their product is falling off, and by September will be materially lessened. My product is increasing week by week, until, from the same number of cows, it is now more than ten

per cent. more than in June, and, experience of previous years has shown, it will be fully ten per cent more in September than it is now."

The Increased Quantity and Quality of Manure.

So much has been already said on the question of manures, that the reader knows what a high value I place upon that produced in the barnyard, and its comparison with the costly and uncertain results obtained from commercial fertilizers.

No farmer needs to be told that, if he has an abundant supply of manure, he can raise large crops. The want of it, more than any one thing connected with farming, makes thousands of farmers and their families slaves to unremitting toil, drudging through life, when if one-quarter of the labor that is spent in trying to subsist by cultivating exhausted soils were turned to accumulating a restorative, independence would take the place of dependence, and the farmer enjoy all the comforts implied by well-filled barns and granaries.

Manure is the very life and soul of husbandry. It is the basis of vegetable production, the substructure on which the farmer can alone hope to build successfully. The attainment of manure by the soiling system is one of the greatest and most characteristic benefits to be derived from its practice, and the amount which thus naturally accumulates far exceeds all anticipation. All who have had practical

experience agree, so far as I have been able to learn, that the value of the manure made under this system, when properly conducted, is worth at the very least twice as much as that made while pasturing, where it destroys as much feed as its virtue enriches the soil. A great part is lost by falling upon rocks, among bushes, and in watercourses. It is evaporated by the sun. But the saving of land, of fences, of food, the better condition and greater comfort of the farm stock, the increase in the production of beef, milk, and butter, and the attainment of manure, are all subservient and subordinate to the one prime object and benefit to be derived from the system, *i.e.*,

The Increased Productiveness of the Soil.

The first, greatest, and most important question that can occupy the attention of Eastern farmers is, in my opinion, how to restore the fertility of our soils; and as to the Western farmer, how he may preserve it. If the reasons already given here have nothing in them of sufficient importance to induce the farmer to adopt the soiling system, the fact that it affords the surest and most economical way of increasing the fertility of his soil should lead him to give the system a fair and thorough trial. And, again, to the farmer who wishes to add more acres to those he already owns, the soiling system affords a certain means of doing so without buying more land. In my own experience, as already shown, soiling has nearly doubled the acreage of my culti-

vated land; it has increased the quantity of manure three times, and the quality of the same to five or six times the amount produced by the hay and pasture system. I find, in looking about, that thirty-six head of full grown stock and seventy acres of marketable crops (by soiling and ensilage) were about as much as under the hay and pasture system was produced from an average farm of five hundred acres. My farm is by no means in a high state of cultivation (about thirty to thirty-five bushels of wheat per acre). The system has done no more for me than it may do for any farmer who will conform to its requirements, which are simple but exacting.

From fifteen bushels of wheat per acre, and other crops in proportion, the old farm at Maple Lane had in eight years quite doubled that, having taken thirty and one-fourth bushels of wheat per acre from the same field that the first year produced only fifteen.

The Increased Acreage.

In older countries the farmers have been obliged to increase the yield of their present possessions by doubling and trebling the acreage of their farms. As in crowded cities they add to the capacity of their factories and houses by building up story above story, so the farmers of these older countries build up their soil until they are two, three, or four stories high. That is to say, they have increased the productiveness of their soil, until one acre is made to produce what formerly required two, three,

or four acres. There is, I venture, hardly a farmer east of the Mississippi who would not be glad to know how this may be accomplished. The secret is an open one—by keeping a large number of farm animals, and this is the result of soiling.

In France and Germany soiling is the rule, and pasturing the exception, and the number of their live stock has been greatly increased since the introduction of the sugar-beet industry. It is hardly necessary to add that their soil has increased correspondingly in productiveness; while under the pasture system productiveness in America has as steadily declined, until the average wheat yield is only about thirteen bushels per acre. Let me show you what the soiling of thirty-six head of cattle did for me by way of increasing the acreage of my farm.

You will remember that I started with twelve head, seven cows and five horses. These twelve head required sixty acres of hay and pasture, besides the coarse forage, such as stalks and straw, that grew on the other forty acres of my 100-acre farm. (I have gone over this once under the head of saving of land. I wish to emphasize it now under this head.) By soiling and ensilage (which is simply winter soiling), I was able to increase my stock from twelve head to thirty-six. Thirty-six head at pasture would have required 180 acres, an increase of 150 acres. At the same time my acreage for marketable crops was increased from forty to seventy acres, or an increase of thirty acres, making a

total increase of acreage of 180 acres, without buying a foot of land; this, added to the original farm, gave an equivalent of 280 acres. These figures are startling, but there is no getting past them. I am not saying what I think may be done, but what actually happened. If we are frightened when we think of the extra labor it will incur to soil our cattle, just think a moment. Is it not worth a little extra labor to add to the acreage of a 100-acre farm another 180 acres without buying it? Nor is that all. The same acres under the soiling system more than doubled in productiveness, as already shown. So that taking the old farm as I started with it, which is about the average of the farms, I have practically increased my acreage from 100 to 500. Do you say that that is too liberal? Just look about you to-day, and see how many 500-acre farms you can find where the system of hay for winter and pasture for summer is the method, and how many can you find that carry over thirty-six head of full-grown stock, and at the same time have under cultivation for marketable crops to be sold off the farm over seventy acres? When you show me that farm, I will show you one that is above the average. Here lies (both soiling and ensilage) the great and undeniable advantage over pasturing. Beside it, all other points here mentioned sink into insignificance.

When ensilage first came out, our experimental stations haggled, and contradicted, and doubted, always looking to the comparative value of hay, or cornstalks, and ensilage, losing sight entirely of the

great advantage, *i.e.*, that by growing ensilage, you made one acre produce what formerly required five, six, and eight. The same is true of soiling. It is the increased acreage without buying more land that gives the system an advantage so wide, so great, so unmistakable that there leaves nothing more to be said. Lately our stations have taken up soiling. Most of them are looking to see how many more quarts of milk are produced by one system over the other. Of course, it is always in favor of soiling, but that is but one of the least of the advantages. Others talk about the saving of fences, better condition of the cattle; but the two great questions are the greater production of barnyard manure, and the still greater advantage that it enables us to double, and treble, and quadruple our acreage without buying more land.

Do you say that this is too good to be true? Do you doubt its practical application to farming in general? Let me show you where a single colony of 1,200 farmers are all producing much better results than any herein reported. I refer to the Channel islands, Guernsey and Jersey. The island of Jersey is twelve to fourteen miles long, and four to seven miles wide. It has a population of 55,000, with 40,000 to 50,000 visitors annually. The average size of the farms is eight acres, and there are about 10,000 acres farmed. On this amount of farming land, there were, according to the last census, 11,891 head of Jerseys and 2,343 horses. This makes 14,234 head of live-stock that are being supported from

10,000 acres of land, nearly one and one-half head for every acre farmed.

The principal industry is the growing of early potatoes for the English markets. On an eight-acre farm will usually be found four or five acres of potatoes (followed by a crop of roots the same season), two acres of grass, and one of hay, oats, and a patch of tree cabbage as a soiling crop for the pigs. Such a farm will carry two to three horses, and seven to ten head of cattle, besides pigs and poultry.

All the cattle are soiled the year around except the cows in milk, which are tethered, that is to say, they are fastened by a rope or chain to an iron peg driven in the ground. The tether is ten or twelve feet in length. They begin at one end of a field, and when they have mowed a swath clean the length of their tether, they are moved on, and so along across the field. By the time the field has been fed over in this manner, it is ready to start again at the beginning. A field is fed over five or six times during a season. Of course, the land is very productive. Three hundred bushels of early partly grown potatoes per acre is about the usual yield. This little island, besides principally supporting this very large population, exports annually of farm products between $3,000,000 and $4,000,000. This 10,000 acres is only a good-sized Western farm. This leads me to say that the Jersey farmers are the best and most scientific agriculturists in the world. They pay from $40 to $75 an acre annual rent for their farms, and make a better living off of an eight-

acre farm, as a rule, than any farmers I know of in America do on 100 acres. This shows what can be done on a fertile soil. This enormous production is principally owing to the great number of farm stock which is made possible by the soiling system.

CHAPTER VI.

PARTIAL SOILING.

My experience in partial soiling is not particularly satisfactory as compared with a strict soiling system. It is a step in the right direction, and is just that much better than pasturing. But, as said before, you get all the discomforts of the system, and only a small share of the benefits. If you should see a man cut his hay or ensilage, and bring it to the barn and dump it on the ground, you would say, "Why do you not stack it properly? See what a great waste and inconvenience. Why do you not run your ensilage fodder through a cutter and put it in the silo, and do the work properly? Half doing a thing is never more than starting." Well, that is how it always looks to me to see a man trying partial soiling. Take my advice and go the whole figure. Do it right, as you would do anything else, and you will, at least, know whether the system is good or bad. You simply do not know how good it is, because you never tried. You can never learn to skate by simply sliding on the ice, or to swim by taking a foot bath.

It is something of an effort to begin. Your neighbors will probably laugh at you and call you a book farmer and that sort, but when you make a 100-

acre farm produce what generally requires 400 or 500 acres, you can satisfy yourself with the old saying, "He laughs best who laughs last."

I do not mean to advise you to go into the system with a rush. Go into it gradually. There are little things that will come up the first year or two that may discourage you, something you did not think of. I shall try to give you my experience and practice, and if you keep near the line, I am sure you will succeed. But when you do try, put your cattle in the barn and feed them there. Put them in daytimes and turn them into a small pasture or enclosure nights; and whatever you do, do not begrudge a little extra labor. You cannot get something for nothing, but you can get more from soiling for the money expended than anything I know or ever heard of in connection with farming.

Objections to Partial Soiling.

One master cow will occupy a whole rack. After she has mussed it over and breathed on it for a time, others will only eat it when compelled to from hunger. Feeding in the field is little better. The cattle drive and hook one another about, and grab a mouthful here and another there, and eat it in fear, when they should have it by themselves in quiet. They tramp upon it, foul it, tramp up the meadow, destroying the grass and tramping in weed seeds to pester you for years to come. One cow sees another ten rods away eating something that looks like

a nice stalk or mouthful, and immediately she is seized with a jealous desire to have that same mouthful, and away she dives. If the other is on the watch, and quick enough, and can run fast enough, she gets out of the way. The most you have gained by this system of feeding cattle is that you have given them a good stirring up. One has lost a horn, another an eye, and by the end of a few weeks the weaker ones that needed the extra feed are mostly cripples, or stand on the outside and eat what the others refuse. The cow that gives milk has shut down, because her principal business now is to chase and fight. Feeding a lot of cows, especially those with horns, soiling crops in a yard or field might do very well if they were being trained for a football match, but you will find that they will do better with half the amount fed to them quietly, each in her own stall. Again, by partial soiling, you miss another great benefit, protection from flies, those little pests that drive the cattle to distraction; instead of filling themselves up to their fullest capacity so that they can give you a brimming pail of milk as a reward, they stand in a pool of water between a couple of bushes or under a thicket, fighting, fighting all day, except when sheer hunger drives them out to seek a few mouthfuls, and when they do go out to feed, it is for themselves and not for you. They must do it to get a bit of fuel to heat their blood and supply a new draught for the hordes of flies that will tap and rob them of it to-morrow.

All partial soiling can do is to patch out a poor pasture. You have not done away with any of the annoyance or disadvantage, and the questions of the saving of land, and manure, and fences, comfort of stock, greater production of milk and butter, are not answered.

All these objections are easily overcome by simply feeding the cows in their stables. The extra labor of cleaning the stables is compensated, it is safe to say, several times over in the question of manure alone. Put them in the barn daytimes and turn them out nights (after milking them), and milk them in their stalls in the morning, thus avoiding all running and chasing, and clubbing them with milk-stools, to say nothing about the greater comfort to the milkers, especially in fly time.

By partial soiling, as was said at the beginning, you have all the loss and inconvenience of pasturing with only a small fraction of the benefits; while the greatest and most important lesson to be had from a strict soiling system, *i.e.*, greater production of barnyard manure, is lost sight of.

Let me admonish my readers who have hitherto practised partial soiling to take just one more step in advance, and you have my word for it that in that one step you will go from darkness to light, from patching an old garment to a new, up-to-date, tailor-made suit which is yours almost for the asking.

CHAPTER VII.

OBJECTIONS TO SOILING.

Extra Labor.

The only objection to soiling that any one can possibly make is the question of extra labor. In the first edition of this work was noticed one other objection which was sometimes made, *i.e.*, lack of exercise. In those days there was not one farmer in ten that stabled his cows winters, to say nothing of summers. This may seem strange to my younger readers, but with the exception of a few dairymen, who furnished milk to town, I believe I had about the first farm barn in the county fitted with cow stables. This was early in the seventies. The objection was that the cattle needed more exercise. In those days, cattle were fed in open racks under open sheds, and under the shelter of straw stacks.

But since that time, there have been great changes in the methods of stabling, until now not one farmer in ten can be found who does not stable his cows in winter. Therefore, mention of this objection, *i.e.*, lack of exercise, has been omitted entirely in this revised edition. The cattle are turned out nights, and

stabled daytimes, so that no one will be found now to object to soiling on this ground.

The question of extra labor, however, cannot be disposed of as easily. But even that has become very much simplified and cheapened. It never was in the first place half as much of an objection as it appears to be. This question of extra labor is a bugbear. First, let me ask you who are not soiling your cows because of the extra labor, to mention any branch of farm economy worth having but that does require extra labor, which generally increases in proportion to the benefits derived. The only exception known of to that rule is soiling. There is, to repeat, not another thing in practice, or that is known, or can be mentioned, where the returns are so great as the returns for the extra labor invested in soiling. The great trouble is that we do not see beyond the mere question of getting something into our cows' stomachs, and if they will get it there themselves, what is the use of our troubling? That's the principle. That is the way we invariably have of looking on the subject. We plant corn because it won't plant itself. There seems always enough of that sort of work we must do without cutting grass and hay for cattle, and carrying it to the barn for them, and then putting it before them in their racks several times a day, and cleaning out the stables after them, and darkening the stables so that the flies won't bite them. That is the way we approach the subject. It looks like the mistress of the house preparing a dinner of quail on toast for

the hired girl in the parlor. How many times are farmers heard to say: "Oh, my cows are quite as able to help themselves as I am to help them. If the best pasture I can give them is not good enough, they can go without." That is the way we generally go about solving the soiling question, and many of us never get beyond that point. The extra labor of soiling over pasturing is greatly magnified. Thirty-six head of cattle may be soiled at an additional cost for extra labor of $1 per day, 3 cents per head. My own experience in soiling twelve head of milch cows is that all the extra labor aside from growing the soiling crop did not require more than three hours a day extra labor, and the work was accomplished by a boy fifteen years old. I cannot give exact cost of growing the crop, etc., as no minute was made of it at the time, but I feel perfectly safe in the above estimate. Let us see in what this extra labor consists: plowing the land, seed, and time to put it in, cutting and delivering the same to the barn and to the cows, and cleaning the stalls. As you will see further on in a detailed account of how this is accomplished, the extra labor to soil cattle over pasturing is very insignificant in comparison to the benefits.

"Soiling," says Mr. H. Stewart, "is a little more laborious than pasturing, but $1 spent in extra labor is replaced ten times over in saving of land, saving of feed, and saving of manure. I have found labor very much cheaper than feed." Again he says: "Besides fifteen cows, there were three horses,

seven heifers, one bull (twenty-six head), and some pigs. All the cleaning, feeding, and attendance on these animals was done by a boy of fourteen years for one year, and the boy had considerable time to spend in field work. The extra labor involved is well repaid by the extra manure made, and the gain from the cattle and the increased fertility of the soil will be clear profit. The bugbear of labor is a phantom. It is imaginary. The need is more for head work than for hand work."

Another writer in "The Country Gentleman," who has had many years' experience in soiling, says, "It requires one man to spend half of his time cutting, hauling to the barn, and feeding forty-eight cows, at $1 per day" (a trifle over 1 cent per cow).

I never could see why a farmer should object to extra labor, when there is found a profit in it. It is rarely that a man accumulates wealth from the labor of his own hands. The carpenter, blacksmith, shoemaker, or other mechanic who ever becomes well-to-do, usually owes his prosperity to the labor of other men's hands. There is a great amount of work to be performed upon a farm that would pay a handsome profit, but, as it does not always return to the farmer directly in cash, he is inclined to apply himself to such work only as puts the "almighty dollar" directly in his pocket. This, I think, is another reason why the soiling system is not more generally practised. Many do not like to see a crop of green rye, oats, or peas cut down and fed to stock, when, by waiting a few weeks longer, they

could harvest it, and deliver the grain to market for cash. It has often been remarked by visitors at my place, who have witnessed the cutting of a splendid crop of oats or rye just as it was heading out, "What a pity!" It is a greater pity, in my estimation, to see a man so short-sighted as to become "penny wise and pound foolish." Such men try to see how little they can feed and keep their stock alive. They go on year after year, plowing wheat after wheat, yearly reducing their stock and the fertility of their soil, and grumbling because "farming don't pay." Let us see what the expenditure of $1 per day for extra labor accomplished in my case. My farm contained only 100 acres of tillable land and pasture. By the hay and pasturing system, as before mentioned, I was able to keep only twelve head of stock a year on sixty acres. By soiling summer and winter, I was able to keep thirty-six head of full-grown stock from the product of thirty acres. Who is there who cannot afford $1 per day in extra labor to produce such results as these?

CHAPTER VIII.

SOILING VERSUS PASTURING.

Penns. Bul. No. 21, page 105 (1889).

"In instituting a comparison between the yields of pasturing and soiling, it is necessary to take account of the fact that, by our system, two crops of soiling are grown on the same ground in the same season. These may be either rye and corn or clover and corn. In computing the yield of corn and adding the yield of rye, and in the other that of the clover, and, finally, averaging these sums, the result is as follows:

	Digestible Organic Matter.	Digestible Albuminoids.
Pasture	1,125	249 pounds.
Soiling, rye and corn	5,776	328 "
Soiling, clover and corn	5,914	374 "

"The average yield of edible, digestible matter by soiling crops is 5.2 times as great as that by pasturing. We may say that, in round numbers, we can produce from three to five times as much digestible food per acre by means of soiling crops as is produced by pasturing represented by our small plots."

Greater Production of Milk.

Iowa Ex. Bul., No. 15, page 274 (1891).

"The losses that occur annually to our farmers from the drying up of their pastures in July, August, and September, induced us to grow a few acres of green feed, and ascertain to what extent such feed of different kinds can be had from an acre of land, how much a cow requires of each kind, and the effects of such feeding on quantity and quality of milk compared with well-watered and well-shaded blue-grass pasture. The principal objection to soiling has been that time is too expensive to be employed for this purpose. Time and circumstances are breaking the force of this argument. Iowa lands have become high-priced. Many of them are stacked with herds of valuable animals that must respond, or they will not pay. Growth, meats, and milk are made cheapest in summer. Droughts of July and August call for something to round out the season's work. These considerations induced the station to begin experiments in this direction. Began June 20th, when the drought was drying up the pastures. We sowed for soiling crops winter rye, clover, oats, and peas.

"Oats and peas were fed from June 20th to July 28th, when oats and second cut clover were substituted until August 8th, when green corn and clover were fed to the end. Six cows were selected; all

received the same ration. Three of the cows, Nos. 21, 22, and 23, were tied up in a darkened, ventilated barn and let out each day for water and exercise. On August 9th, they were turned out and the other three, Nos. 209, 220, and 244, were tied up. They were fed eighty pounds daily of forage crops except Nos. 220 and 244, that had one hundred pounds each, being larger cows. The milk was weighed each milking and analyzed by the chemist periodically.

	Milk.	Fat, Pounds.	Solids, Pounds.
Cow No. 21 in stable 48 days	133.700	47.199	162.671
Cow No. 21 in pasture 48 days	104.800	39.785	134.053
In favor of soiling	28.900	7.414	286.18
Cow No. 22 in stable 48 days	127.250	43.685	156.088
Cow No. 22 in pasture 48 days	117.050	40.560	146.895
In favor of soiling	10.200	3.125	9.193
Cow No. 33 in stable 48 days	133.825	45.632	160.897
Cow No. 33 in pasture 48 days	111.075	41.137	137.835
In favor of soiling	22.750	4.495	23.092
Total gain	61.550	15.034	142.903

Summary.

"The cows first tied up increased in milk while in the stables, and lost very fast as soon as they were put in the pasture. Cows tied lost heavily on pasture, and gained in milk as soon as they were put on green feed. We were feeding indoors against one of the best blue-grass pastures in the State, well shaded and running water accessible. Of the three cows put in pasture first, June 20th, when it was at its best, Nos. 229 and 220 were fresh cows and 244 was

more than an average cow. With the grain ration given them, they had greatly shrunken on the pasture by August 8th, while the three tied up for the same period gained considerably. The indications from the experiment are: that the average cow will eat seventy-five pounds of green food a day kept in the stable, with a grain ration added; that cows fed on oats, peas, clover, and corn, fed green in the stable in midsummer, will give more milk than when feeding on a good blue-grass pasture; that a cow fed on green feed in stable darkened and well ventilated will gain in weight more than she will in a well-shaded pasture; that a cow will respond more readily to a well-balanced ration of grain while eating green feed, than she does on dry feed. An acre of oats and peas cut green weighed twenty-four tons, and an acre of corn and oats cut green weighed thirty-three tons. It is not necessary to cut green feed oftener than twice a week, if it is spread to avoid heating."

CHAPTER IX.

ROTATION OF SOILING CROPS.

Laying Out the Work.

In laying out the work it is simply necessary to know how many head of animals we wish to soil. If some are calves or yearlings, estimate about 1,000 lb. live weight as equal to a full-grown animal. For the sake of illustration, let us suppose that we wish, the coming season, to soil ten cows, three two-year-olds, four yearlings, seventeen head, equal to fourteen head of full-grown stock weighing 1,000 lb. each. The first thing we wish to know is how much land we will require per day, week, or month to supply the necessary amount of forage. The following estimate has been adopted of the land required for a full grown animal per day:

Of lucern, clover, three-fourths square rod per day. Of barley, oats and peas, rye, wheat, millet, one-half square rod per day. Of corn or sorghum, one-quarter of a square rod per day.

This is a fair estimate for a day's feeding on land in a good state of cultivation. For a beginner it would be well to add, say, one-fourth more in each case until he learns the capacity of his soil. When land is in a high state of cultivation, it will require

less than the estimates first above given. No cow can possibly consume half a square rod of rye, barley, oats and peas, or millet in a day's feeding, where there is a good strong growth.

I cannot lose this opportunity to call your attention to the great feeding capacity there is in an acre at this rate. There are 160 square rods in an acre. This, at one-half square rod per day, gives 320 days' feeding from one acre.

It is always best to make a liberal allowance. There need be no waste, since any surplus may be cut and cured for winter forage, or, better still, plowed under as green manure.

In laying out the work necessary to provide for fourteen head of full-grown animals, we will start the fall before the season we intend to begin soiling, and carry the work along for the year. The first question is to decide how much land shall be allowed to grow the necessary amount of forage. Fourteen head of cattle (consuming, say, three-quarters of a square rod per day) will require ten and one-half rods per day, or seventy-three and one-half rods per week; say eighty, an even half acre. This will require for June and July (eight weeks) four acres of ground. Then we add the necessary corn ground, two acres more for the August crop; the September and October crops are grown on the land from which the June and July crops were taken. For June we, therefore, sow during the autumn this six acres, more if possible, to rye and wheat. Wheat sown at the same time as rye will follow rye the next spring,

as it is about a week later. These seedings of rye and wheat should be top-dressed with manure during the winter. We, of course, cannot use all this rye and wheat next spring for soiling: at least, two acres of this will be plowed under in the spring, but it is better that the land should be growing something during winter, as a mulch and collector of nitrogen, than to lay barren or fallow. Soon as spring opens, we plow under two acres of the four acres. You say, why not let it grow? Because you will not require it all, and because oats and peas are better soiling crops. But, perhaps, you do not like the idea of wasting the seed. Don't be alarmed. That $2 worth of seed has been accumulating many times its cost in plant food during the fall and winter. There is nothing lost, but a decided gain. True, the rye is only a few inches high, but the roots have been taking up the plant food from the manure spread upon the land during the winter. Plow it under. Now we come to an important question. How much of this two acres shall we sow to oats and peas at a time?

One week is about as long as any soiling crop (corn or sorghum excepted) is at its best for soiling. We, therefore, sow enough every week to last a week. If we put in more than this at a time, we either have to begin cutting it before it is at its best, or continue to cut it after it has passed its best. A soiling crop is fit when the grain is well in the milk; before that it is too watery, after that it soon becomes tough and woody. And right here,

in my opinion, has been a great drawback to successful soiling. Men have planted too much at a time, and the soiler has been disappointed in the result. His cows have shrunken in their yield of milk, and no doubt many a man has thus become disheartened in his first attempts at soiling.

Crops for July.

It has been my practice to plow in the spring, and sow first a week's supply of barley. Barley will germinate at a lower temperature than oats. Following this a sowing of oats and peas is put in weekly. The barley and oats and peas are for July. The wheat and rye of last fall's sowing were for the later half of May, through June, until the barley or first spring crop is ready.

With fourteen cows it will be necessary to put in half an acre a week, beginning in the spring as soon as the ground will permit. Saturday is usually devoted to this weekly task. It is better to plow at one time (after the first week's seeding of barley) or as soon as the ground is warm enough, say an acre and a half. Plow deep. This will make land enough for three weeks' seeding of half an acre per week. Then let the farm team devote every Saturday afternoon to fitting that half acre, and sowing the oats and peas.

Of barley, sow two and one-half bushels per acre. Of oats and peas, three bushels per acre, half and half, common Canadian field peas. The one sowing

of barley and three of oats and peas are depended upon to supply the July feeding. These four spring seedings I have been able to get in (in Western New York) during the month of April. This brings us to the question of supplying the

Crops for August.

With the last sowing of oats and peas, whenever it is (either a week earlier or a week later than last year signifies nothing. Go straight along with the programme), make the first sowing of corn Stowell's Evergreen (or some other medium-sized variety), and continue with corn and sorghum during the month of May for the August and first week of September; as corn is longer in condition to feed than oats and peas, more can be sown at a time. I have never practised it, but think very highly of the idea of sowing sorghum in alternate rows or in the same row with corn. These crops may be sown on the land from whence came the wheat and rye cuttings in May. The sorghum or corn and sorghum should be sufficient to last through the first half of September, or as long as it is safe to depend upon its not being cut by frost. This brings us to and into

Crops for September.

As the barley and oats and peas are consumed in June, the ground they occupied is put into millet and barley for October (to be followed by ensilage

from the silo). As to the sowing of millet, put in all the ground you can of this, and plow under (what is not consumed in the autumn by soiling) for rye next spring; and the land that was devoted to corn and cut off in August is all put into rye for next spring. This completes the year.

It seems as if a great many words had been used in describing this simple rotation. If I am at fault in this, I hope the reader will attribute it to my desire to be clearly understood. The whole thing may be stated in a nutshell as follows: In the fall sow rye to plow under for soiling crops until barley or oats and peas are ready. In the spring sow early as ground is fit to work, four or five sowings, a week apart, of oats and peas. The first sowing of barley if the spring is cold and backward. With the next to the last, and the last sowings of oats and peas, sow corn and sorghum, four or five sowings, to carry until middle of September, to be followed by millet and barley for late autumn.

Oats and peas are sowed on rye plowed under in April, corn sown on rye plowed under in May, corn and sorghum sown on land soiled from during June, millet sown on land that rye, oats, and peas were cut from in July, rye sown on all corn ground cut over, for soiling in August and September. October 1st, sow the balance of the land not already into rye for next spring, either to cut or plow under for soiling.

So far a rotation has been shown independently of clover, lucern, or crimson clover. These were pur-

posely omitted, advising the soiler to work into lucern gradually, and as to crimson clover my own experience has not been successful, but others have been. If you will begin with the rotation given, you will soon find opportunities of branching out with the clovers. It is not advisable to depend upon common red clover; oats and peas are better. By all means, however, have a patch of lucern for the horses, if nothing more. The following interesting letter is from Mr. Charles Wolcott, Blue Hill Farm, Canton, Mass., June 11, 1881:

F. S. Peer, Esq.

DEAR SIR: I have yours of the 4th and note the inquiries. Our practice has been to feed upon winter rye first, then oats, next spring rye, next millet (the golden) grown on the winter rye land. Sweet fodder corn (Stowell's Evergreen) grown on oat lands, Southern white fodder corn sown in drills on oat land and spring rye land, and, lastly, barley grown on the land formerly occupied by winter rye, and lastly by golden millet. This gives a good rotation for feeding, and with us always has worked well. Respecting the value of manure saved by soiling, my judgment is that all that is made is saved, for I do not believe that the manure dropped in pastures enriches the soil at all, it being mostly dried up into an almost insoluble cake.

The care of my stock (now forty-eight head of milch cows) devolves on one man, who feeds, cleans, and waters them in the barn, two men to help him milk. One man and one horse draw the green fodder in less than half a day. We feed three times a day in the stanchions, where the cows stay except when they are turned out once a week in the yard if it is cool, for an hour, but never if it is hot. They much prefer the barn to the yard. Their health is always good, and they are thrifty. The quality of milk with me is about the same the

year round. The quantity is larger with me in the soiling season than my neighbors average.

To conclude, I will say that I cannot see that I can afford to pasture my stock, as I haven't made enough money yet to be able to throw it away.

Yours respectfully,

CHARLES W. WOLCOTT.

CHAPTER X.

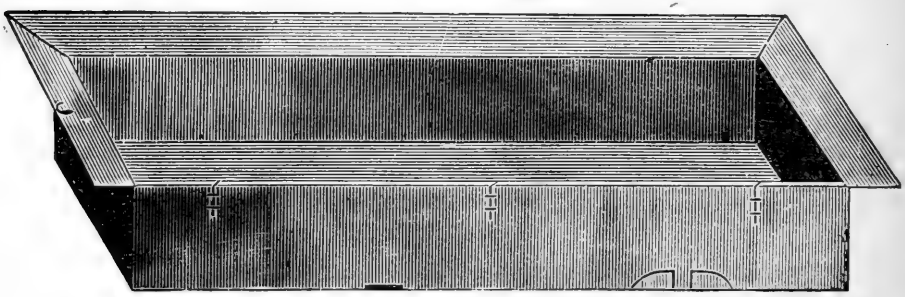
CUTTING AND GATHERING THE CROPS.

Necessary Tools, Etc.

My own experience in soiling twelve to fourteen head of cattle and four horses may be briefly stated as follows: The cutting was done with a D. M. Osborne self-rake reaper No. 3. I began with a scythe, then the mowing machine, but the reaper was the thing, throwing it off in gavels in the best possible way to facilitate handling, and where it will wilt without drying out. Monday morning, for instance, the farm team is attached to the reaper, and cuts in twenty or thirty minutes enough feed to supply the stock for two days. This reaper was used for three seasons for this purpose, also for cutting the ensilage corn. Nowadays the self-raking reaper has generally been supplanted by the self-binders. I have letters from several binder companies, saying that they will guarantee their machines to cut the green crops for soiling, and no doubt they can. It need not and should not be bound. The improved corn cutters leave little to be wished for in the gathering of the corn forage for soiling or ensilage, and the work and expense of harvesting are with these machines reduced to a minimum.

Delivering to Barn.

A one-horse lumber wagon, truck, or half truck with wheels two and one-half to three inches wide will be found to be of great service, and will answer



BOX FOR WAGON.

the purpose until the number of head soiled reaches twenty-five or more, when a two-horse wagon with wide low trucks (which is also most useful in harvesting ensilage fodder) will be found advisable.

The box for the wagon I had in use for this purpose was a double one; the upper box was put on in four separate pieces (two end and two sideboards) which projected over the sides of the main box as shown above.

Feeding.

There is but one satisfactory way of feeding soiling crops, and that is to the cattle fastened in their stalls. Each cow gets her share, with no running or chasing about. She eats what is put before her,

and is satisfied. She is in the best possible position to be milked, and her greater comfort has already been explained.

Caution in Feeding.

There is more danger of feeding too much at a time than not enough. There is no doubt but that here lies the reason of many discouraging results in soiling. Of the three great mistakes a beginner is apt to make, *i.e.*, feeding soiling crops in open racks, sowing too much at a time, and feeding too much at a time, the latter is probably the greatest mistake of the three.

A cow with more fodder (especially green forage) in her manger than she can eat up clean at the time, will go hungry sooner than eat it after she has breathed upon it for a time. This, of course, causes a shrinkage of milk, and is, I am sure, the reason why the soiling system has, in some cases, been condemned by some who suppose their cows abundantly provided for, when their manger stands full of feed. They cannot understand how it is that their cows do not do as well at soiling as at pasture, and they jump to the natural conclusion that the cow or cows are pining for open pasture, and if they turn them out, they would undoubtedly gain in milk for a day or so; then they would say that their cattle do better at pasture than at soiling. The trouble has been that their cattle have been hungry in the midst of plenty. After a cow breathes on forage

left in a manger for a time, it becomes very distasteful to her, while to the feeder it looks bright and fresh, and she gets no more, perhaps, until hunger compels her to eat that up.

Whatever you do, always remove from before the cows all that is left in the mangers before giving them a fresh feed. You will be surprised some time to see a cow go greedily at a fresh feeding at noon, when you have taken from her manger what she failed to eat in the morning.

If there is anything left in the manger, pass it over to the hogs. They will be very pleased to have it.

Manner of Feeding.

Experience has taught me that, to produce the best results from milch cows, they should be fed four or five times a day. Five feedings in my experience have given better results than four, and just as good as six.

To think of feeding cows five times a day, when the usual custom is to feed but twice, may seem like a great task, but by systematizing the work it will be found not nearly as difficult as one may imagine.

Let us follow a day's work in feeding fourteen head of cattle five times a day, *i.e.*, at 5 and 8 A.M. noon, and at 4 and 7 P.M. Enough feed has been delivered to the barn the evening before for the first morning feeding, which the cows find in their mangers when they are let into the barn from the yard, or paddock, or orchard where they have spent the

night. After breakfast the farm team is attached to the reaper, and in twenty minutes or half an hour has cut enough forage to last two days, and has gone on to its regular farm work. I found a boy fifteen or sixteen years old quite able to do the extra work of drawing, feeding, cleaning stables, etc., and have about six or eight hours a day to devote to the regular farm work. After breakfast the boy feeds calves, pigs, etc., and at 7:30 with the one-horse wagon goes to the field and draws to the barn the 8 o'clock feeding, which he delivers into the mangers from the wagon, and leaves upon the wagon enough forage for the noon feeding. The boy is now at liberty to work elsewhere on the farm or in the dairy. At noon the forage that was left on the wagon is given to the cows, a work of 10 or 15 minutes. Other employment is found for the boy until 3:30, when he goes to the barn, puts the horse to the wagon, and delivers to the cattle their 4 o'clock feeding. He then draws in enough forage for the 7 o'clock feeding, and the first (5 o'clock) feeding for the following morning. He then cleans the stables, assists in milking, and at 7 o'clock gives the final or fifth feeding to the cattle, which is quickly done. This ends the day, with the exception of turning the cattle out at 8 o'clock for the night. They have free access to water in the yard when let out for the night. They require no more water during the day.

In thus relating my own method and practice in providing for fourteen head of dairy cows, I am well aware that it might not be suited in every respect to

every other man's case. It is hoped, however, that it will give my readers a correct knowledge of the general principles of the system, so that those who may wish to adopt it will have a guide, if not an absolute rule. The things insisted upon as absolutely essential to success may be summed up as follows:

First.—Feeding the cattle in their stalls day-times, turning them out at night.

Second.—Sow every week during April, May, and June enough ground to supply a week's feeding only.

Third.—Remove all forage left in the mangers before each fresh feeding.

Fourth.—Feed five times a day all the cattle will eat.

Fifth.—Supply perfect ventilation. Open stable doors at night. Keep doors and windows closed day-times, the latter darkened to exclude the flies. (But this can only be done when the barn is properly ventilated.)

These five rules are laid down as the cardinal principles. As to all the rest, use my experience as a guide, and better it wherever you can. Anyway, adopt any method that will best serve the five rules.

CHAPTER XI.

BARN CONSTRUCTION.

General Plan.

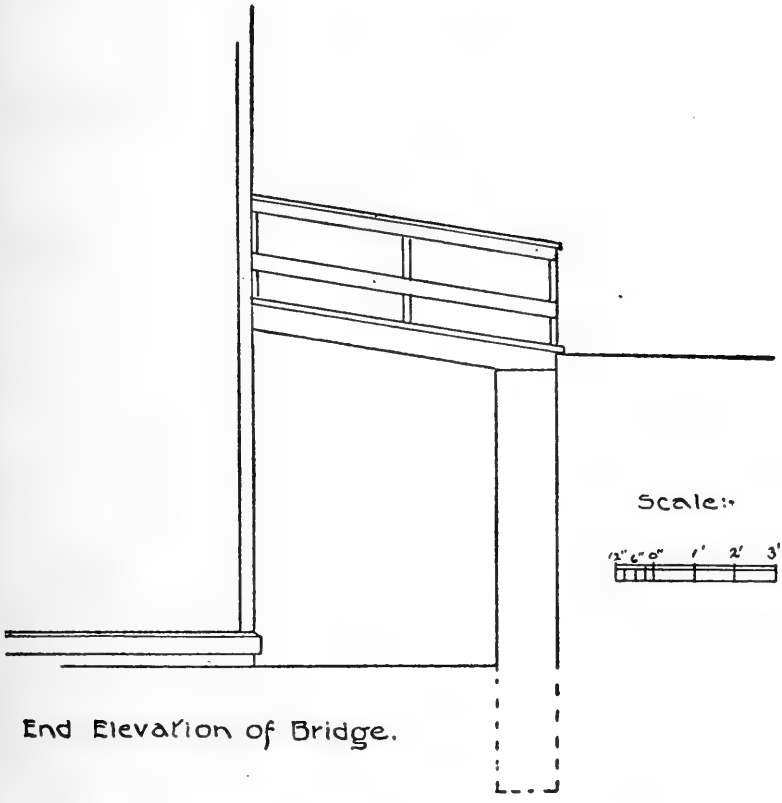
The principal requisite in the construction of barns for soiling summers and feeding ensilage winters is to have a driveway through the barn, so that the soiling crops and the ensilage may be fed to the stock directly from the wagon into their mangers. If the barn is wide enough so that the cattle can stand with their heads toward the centre, and still leave room for a passage behind them, so much the better; but if the cows face the walls with only a manger in front, the cattle may still be fed quite handily from a passage behind them, while the passage may be used in carting out the manure, which may be delivered direct from the stables to the field in one handling. This plan is preferable, unless, when the cows face the centre, there is still room behind them for a wagon drive for the manure. The object, of course, is the saving of labor. A barn thirty-five feet wide will accommodate two rows of cows facing the walls, and give a ten-foot drive behind, and a four-foot passage in front of them, whereas, if they face the centre, and there is a drive

behind them for manure and one in front for soiling crops, the barn will require to be at least fifty feet wide; although it is not quite as convenient to feed the cattle their soiling crops from behind, especially if they are fastened in stanchions, the great economy in building the barn thirty-five feet wide instead of fifty is considerable. With open mangers, the cattle may be fed from the drive behind them nearly as well as from in front. Therefore, it is preferable to have them face the wall and a drive behind them, especially if the number of cattle is great enough to deliver the manure from the trench directly to the field. Of course, if there are but a few, and the stables are cleaned by the use of a wheelbarrow, and a narrow passage behind, I would in this case recommend the cattle to stand facing the centre. A barn on this plan also should be at least thirty-five feet on the inside. This will leave a feeding passage ten feet wide in front of the cows.

The next thing to be considered in the construction of a barn is that it should be warm in winter and cool in summer. The best possible construction of a barn to attain this end is to build it with two air spaces between the outer and inside coverings. A barn built on the most approved plan for keeping ice, or for cold storage, or refrigerator purposes is best to accomplish this end, *i.e.*, to keep out the cold in winter or keep out the heat in summer.

Objections to Masonry Basements.

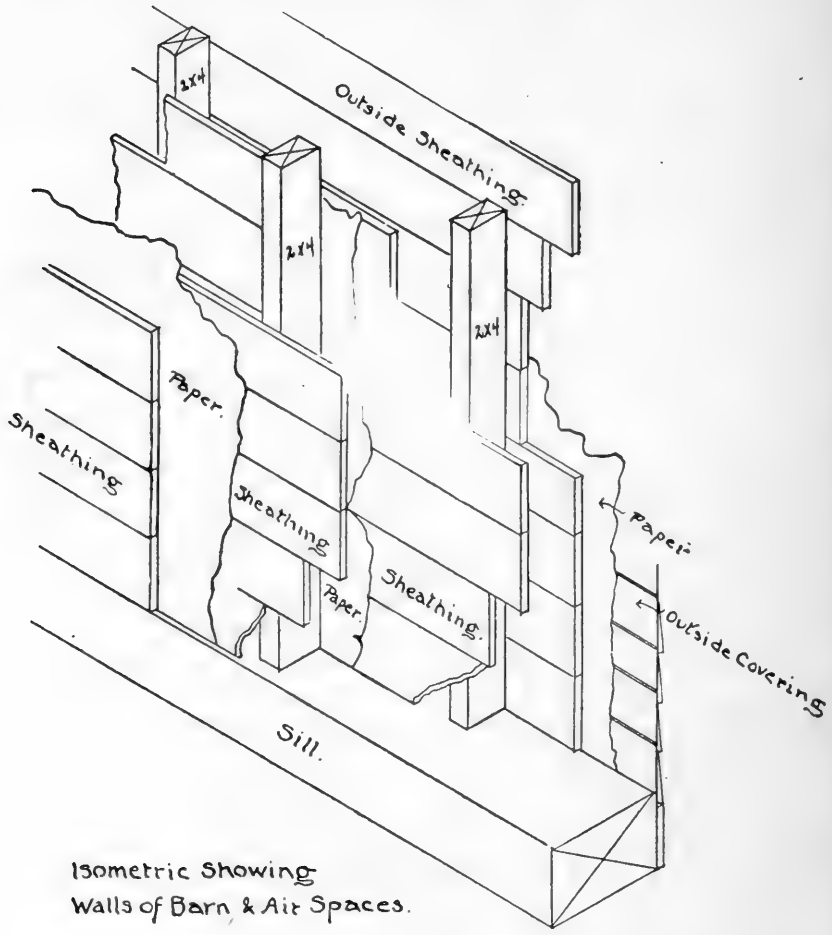
I have had much experience with stone and brick wall basements, and would on no account recommend them for any kind of stock. They are, as a



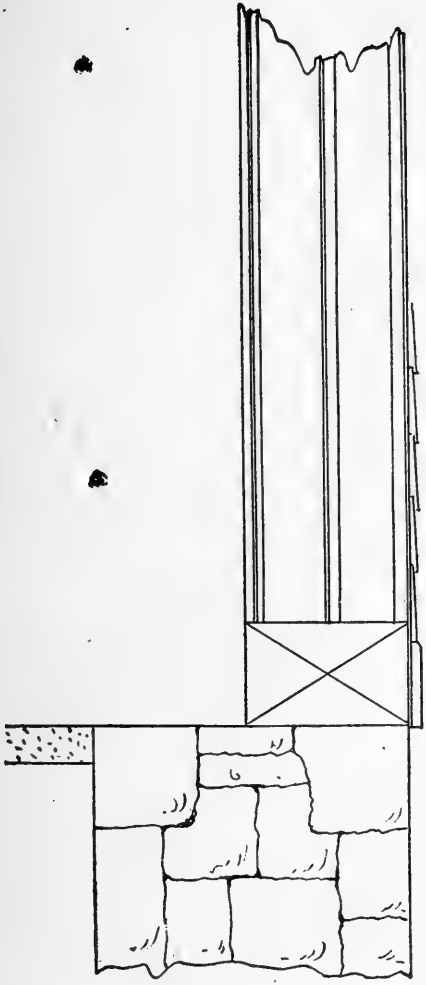
End Elevation of Bridge.

rule, damp, chilly, and unwholesome, if not unhealthy, a great portion of the year. I am so prejudiced against them, compared with double air-

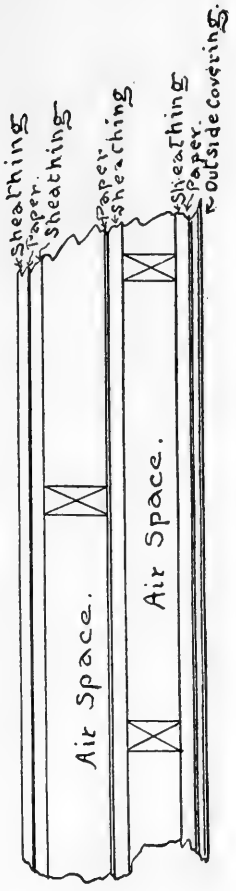
spaced wooden walls, that I would not have one put under a barn of mine if it could be done without cost. If it is necessary to build a barn with a base-



ment, I would recommend excavating back from the foundation, and driving into the upper story over a bridge six or eight feet long, as shown (cut, p. 105).

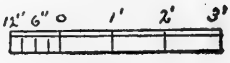


Vertical Section
of Barn Wall.



Cross Section
of Barn Wall.

Scale:-



If the cattle barn is to be under the main barn, as is usually the case, or simply a shed, the method of constructing walls with double air spaces is as follows: On the sill twelve inches wide, set up a two-by-four one inch back from flush with the outer edge. On this nail sheathing, on the sheathing building paper, over the building paper clapboards or novelty siding, or whatever siding is desired for the outside of the barn. On the inside of the two-by-four studding nail inch sheathing; over this building paper; then set up another two-by-four against the inside or middle lining, and on the other edge nail sheathing, then building paper, and cover with matched siding (see cuts). The idea is to get two dead-air spaces. The nearer airtight the spaces are the more perfectly the cold will be excluded in winter or the heat kept out in summer. An airtight air space is one of the best non-conductors of heat or cold for barn, silo, or icehouse. It is far better than to have the space filled with sawdust. Where lath and plaster is more economical than sheathing and building paper, it makes an equally good partition, dividing the two air spaces. This method of building side walls is less expensive than stone or brick masonry, and when finished is so much warmer in winter, so much cooler in summer, so much drier, cleaner, airier, and more wholesome, that there is no comparison between the two.

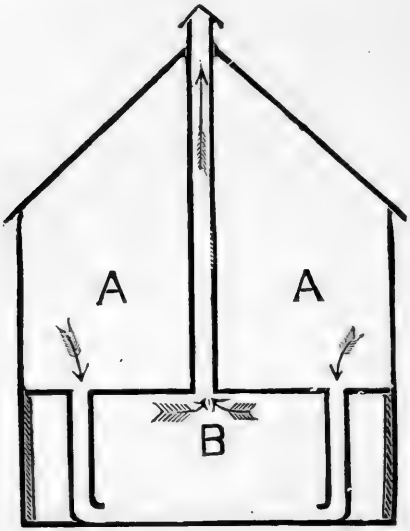
The windows should for the same reason be made to accommodate three sashes both for winter and summer. The windows, however, should be large

and numerous, but they are never to be opened or used as ventilators. This plan is for the basement. Above, the barn may be built in the usual way with single siding, unless a horse stable, calves or sheep pens are to occupy the upper floor, in which case their quarters should be surrounded with similar walls. Outside walls of such a construction will require no artificial heat in winter to keep the stable warm, a system that is both expensive and needless, and will be as cool as it is possible to have a barn in summer. Eight feet in the clear is enough if properly ventilated.

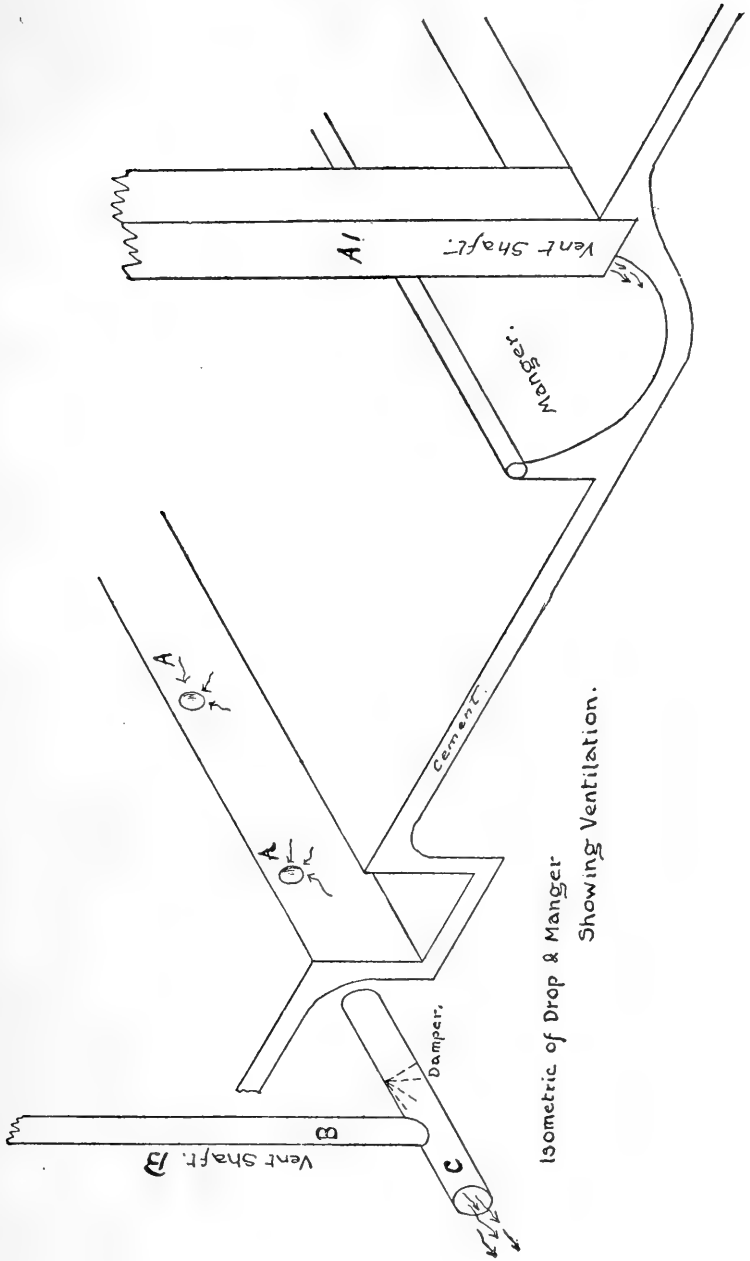
Ventilation.

The next great question is that of proper ventilation. It has just been said that windows are not to be used summer or winter for ventilation. It is unnecessary, and can be attained more perfectly in other ways. The question is to admit fresh air and to dispel foul air. My method would be as follows: The foul air is of two kinds, the warm air from the animals' bodies, which is lighter than the air and ascends, and the poisonous gases, which are heavier and stay on the floor. We must, therefore, provide an exit for both. The former is easily gotten rid of in the usual way by a ventilator in the floor of the ceiling to a point above the ridge by a wooden shaft surmounted by a cupola. Taking advantage of the fact that the cooler, fresh air is heavier than the heated air of the stable, therefore it best supplies the exit of the latter, by coming into the stable

near the floor on which the animals stand. This air either in winter or summer for a small stable may be supplied from the inside of the barn at the floor of the room above. The reason is that the temperature there is cooler in summer than if taken from the outside, the coolest air in the barn above being on the



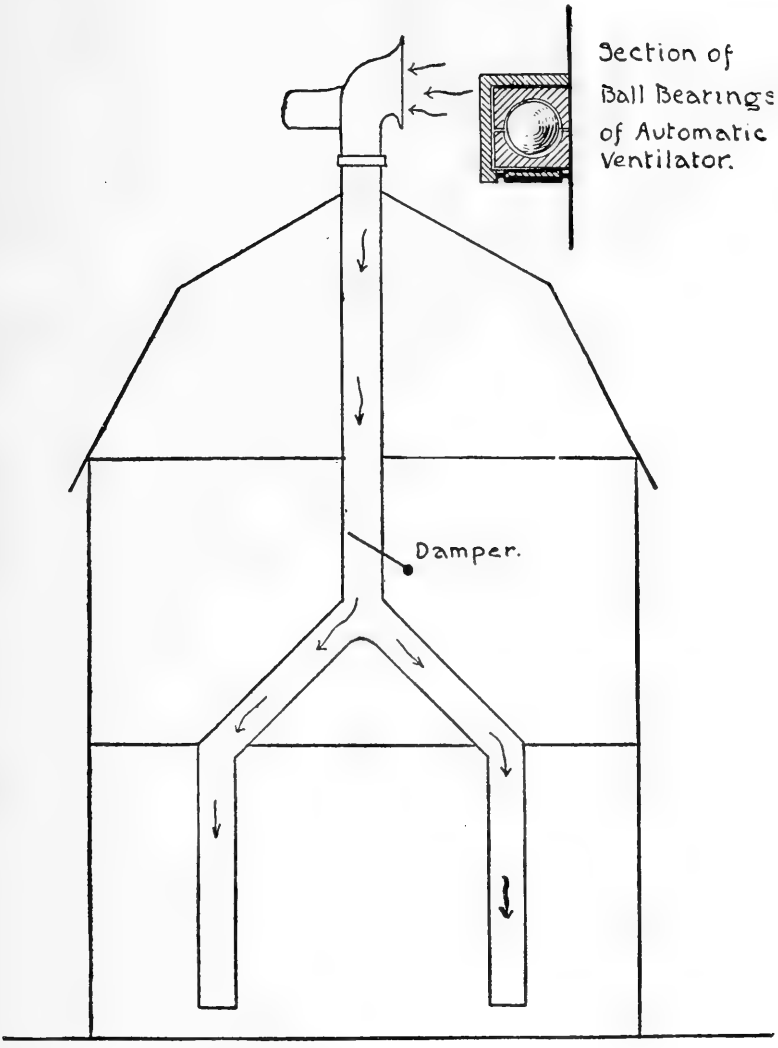
floor. It is equally advantageous in the winter, because no matter which way the wind is or how hard it blows, the air from the room above is steady and uniform both in movement and temperature, that is when the barn doors upstairs are closed. We, therefore, prefer to get our fresh supply from indoors (above) rather than from the outside. To accomplish this, we may use wooden air ducts as shown above, opening from the floor above, and discharging in front of the cattle into their mangers, or near their heads so that



Isometric of Drop & Manger
Showing Ventilation.

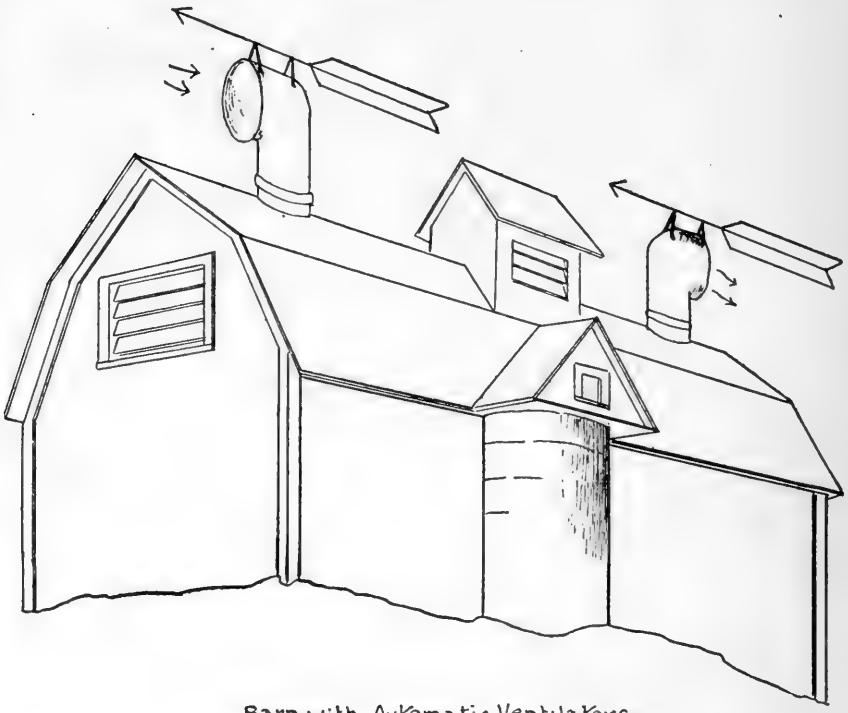
they can get it pure. We have now provided for the entrance of fresh and the exit of heated and impure air, but we should still provide a place of exit for the impure air that is heavier than the fresh air. This is accomplished by an air duct opening lower than the entrance of the fresh air, and must be carried by a tile duct or conductor pipes and allowed to discharge underneath the barn or lower than the barn floor, or allowed to discharge into the liquid manure cistern, in which case a swinging damper closes automatically if air attempts to enter through this duct from the outside. The cut (page 111) shows this air taken from the gutter behind the cows and in a tile drain discharging into the liquid manure cistern. This same pipe also provides an escape for the light foul air or gases that may rise from the cistern, as shown in the cut at *B*. This is simply a galvanized conductor pipe that is carried above the building on the principle of trapping a sewer pipe discharging into a cesspool. If cattle barns were thoroughly and properly ventilated, there would in all probability be less tuberculosis among our herds than there is at present. Pure invigorating air is the best of all preventives, if not a cure, to consumption in the human family; why not in cattle?

The fresh air comes into the barn through shaft *A*, and is conducted along on an air duct directly in front of the cattle, as shown, discharging into each manger (see page 110). This air shaft in front of the manger comes into the stable at each end of the barn (as shown on page 110, for a small number of



Section. Automatic Ventilator.

cattle, and on page 111 for a larger number). The forced-air shafts should have shown the damper on the floor the cattle stand upon, where it may also be



Barn with Automatic Ventilators

regulated by hand by moving an adjustable weight in and out on the damper shown in the floor above.

A good place for the exit of this carbonic-acid gas out of the barn is from holes along the side of the manure trench behind the cattle, *A A*, as it seeks the lowest level. The same ventilator *B* takes the warm, offensive air from the fresh droppings to the top of the building (as shown). With a large number

of cattle it may be found desirable to force air into the barn from the outside. Ventilators regulated by the action of the wind, with automatic check damper, as shown in cuts (pages 113, 114). W. E. H. Massey, of Toronto, has adopted this method with great success.

The first cut shows an automatic ventilator which revolves on ball bearings, and is kept facing the wind on the principle of a weather vane, which keeps the opening of the ventilator always facing the wind, thus forcing the fresh air down the shaft. An automatic damper in the shaft regulates the supply so that a wind-storm could not drive in more air than was needed. This automatic damper can be regulated to suit any strength of current, or closed entirely by hand.

The draft of an outlet ventilator may likewise be greatly increased by making the opening always face in the opposite direction to the wind, as shown.

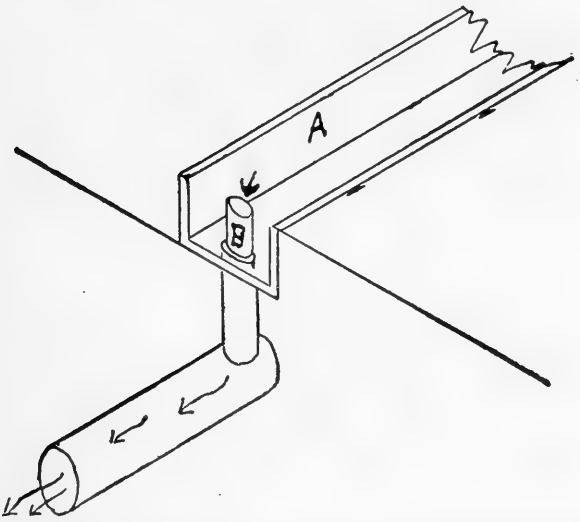
While discussing this question of ventilation, I may take this opportunity to call the reader's attention to the reason why it is particularly necessary that dairy cows especially should be supplied with a great abundance of fresh air aside from its health-giving properties to all animals. Milk is a product of the blood. Therefore, no cow can manufacture a large quantity of milk without first manufacturing a correspondingly large quantity of blood. The blood is made from the food the cow consumes, but in manufacturing a large quantity of blood a large quantity of pure air is required to enter the lungs of the animal to purify the same. So you see the re-

quirements of a good dairy cow are, first, capacity for food, large paunch powerful machinery for digesting and assimilating the product; second, she requires a large lung capacity to purify the blood from which milk is the product. Then if she has a muscular jaw, heavy muscular lips for milling the foods, and large open nostrils for supplying a large pair of lungs, we have the essential machinery of a productive dairy cow, and the necessity of supplying an abundance of fresh air is apparent.

Water.

There is one other requirement that our barn must not fail to have, and that is fresh water in abundance. Water is the least expensive of all the other things that go to make up the raw material from which milk is made. Personally I object to water continually standing before the cows in their stalls. Ensilage and soiling crops are very watery, and cows are apt to get into the habit of drinking for want of something to do, and bowel trouble is the result, caused by the washing of undigested food past the third and fourth stomachs, causing irritation and looseness of the bowels. Give them all they want to drink at a time, and at least twice a day, but shut it off and empty all troughs. The individual iron troughs are usually operated by a float, and the troughs stand full all the time. There should be some means of shutting off the supply, and emptying every trough. I have seen most of the patent

troughs, but none of them that I know of answer all the requirements, flushing at drinking time, emptying, and keeping empty after and between watering times. In preference to these I must still recommend a trough that I used for several years

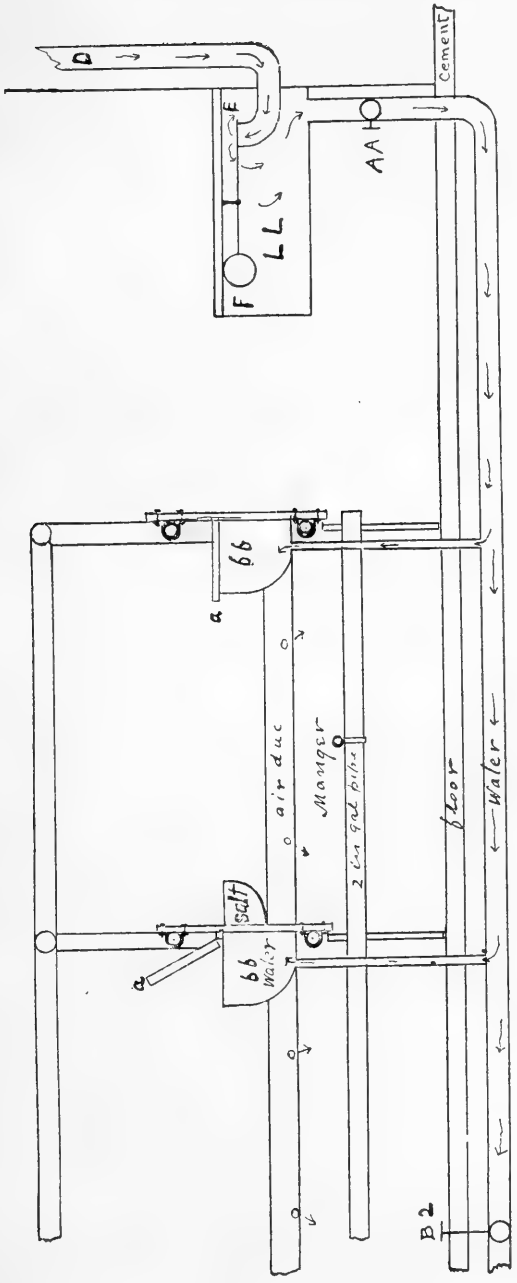


Hinged Water Trough & Overflow.

most satisfactorily. It is shown above. It is simply a wooden or sheet-iron trough on hinges, or not fastened to the opposite side of the manger. When not in use, it is turned upside down; nothing can get into it. It is thus kept absolutely clean. When wanted for use, it is simply turned over in front of the cattle and fits into notches cut in the partitions separating the mangers. Then it is filled by a faucet or a hose at one end. There is a hollow plug *B* in the trough that takes care of the over-

flow, which discharges into a two-inch drain pipe. The water is left running until the cows are through drinking. Then it is shut off and the hollow plug is removed; this empties the trough. This overflow is at the same end as the supply faucet. When the trough is emptied, it is turned over until again required. One trough to every four or five cows is about as long as can be conveniently managed. (The hinges should be of galvanized iron.) Of course, this requires a little more labor than where each cow has a separate trough that is full all the time, but there is a great objection against that method of watering cattle. There is as much benefit to be derived by having a drink of pure, fresh running water when wanted, as there is in having pure, fresh air to breathe. It is not a mere question of slaking thirst in the one case, or the filling the lungs with air in the other. It is the freshness of both that stimulates.

If it is considered advisable to use individual water buckets, the following system of piping is advised, as shown on page 119. *D* is the inlet pipe from spring or tank *B*; the valve *E*, which is governed by a float *F*, that shuts off the water when the receiving tank is full. To water the cows close valve *B* 2 and open valve *AA*. Every individual bucket *bb* will thus be filled to a level with the water in the receiving tank *ll*, which is automatically shut off as soon as all the buckets which are set on the same level are full. When the cattle are through drinking, close valve *AA*



Section through stalls showing Individual Water Troughs.

and open valve *B* 2, thus emptying all the trough entirely into a sewer or the liquid manure cistern, which, of course, we must now provide. Between the barn, and the discharge of the water thus drawn off there should, of course, be a trap, which trap is ventilated, as shown on page 114. This plan overcomes all the objections which I have mentioned in connection with individual watering troughs. It supplies pure, fresh water which is never allowed to stand or become contaminated by the impurities of the air. It provides for a simple and inexpensive drainage that can never clog, and does away with all floats in the trough that get out of order. The troughs are covered with a wooden cover *AA*, which I saw in operation in Mr. James Forsyth's barn at Owego, N. Y. When a cow wants a drink, she puts her nose against the cover, raises it, and helps herself. Mr. Forsyth assures me that the cows "catch on," as he expressed it, very quickly. This keeps the trough always clean and free from dust. The inlet and discharge pipe are the same. The flow and discharge comes straight from the main pipe into the bottom of the trough, and is easily cleaned. A three-fourths-inch pipe supplies the troughs, while the main pipe is two to three inches, according to the number of cattle and length of the stable.

Handling the Manure.

The points we wish to study are how to build a barn adapted to soiling, with the view of reducing the cost of labor to a minimum, which it is well to do in the construction of all farm buildings where labor for any purpose is employed.

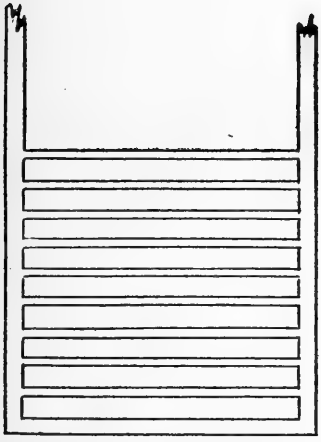
The question of barn construction as to the economy of handling the manure is a problem worthy of our attention. The most economical plan is to cart the manure directly from the stable to the field, and spread it broadcast in the one handling. It is not always convenient to do this, and at some seasons of the year the land is not in condition to receive it. However, during the greater part of the year, it may be carted directly from the stable to the field and spread from the wagon. I believe that there is no more effective way of manuring the land, and getting the greatest good from barnyard manure, than to spread it broadcast on the ground as fast as made, either summer or winter. I have demonstrated this several times. A manure spreader is a most convenient and labor-saving machine, especially when this system of delivering is adopted.

My idea of a trench behind the cattle is to have it deep and narrow, instead of, as usual, wide and shallow. A deep, narrow trench prevents cows standing in it with their hind feet. It holds two or three days' droppings without soiling the cows when they

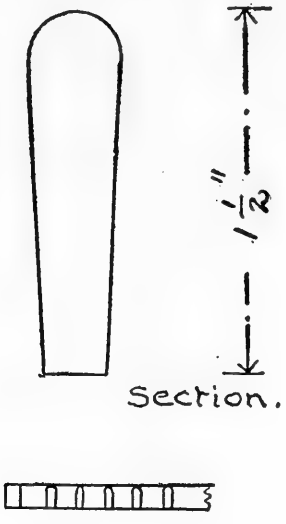
lie down. If narrow (the width of a scoop shovel and little more) the cows can easily step across it, whereas, when it is only four or five inches deep and, as usual, eighteen inches wide, they must step down and into it in getting to and from their stalls. The most satisfactory drop with which I ever had experience was one sixteen inches deep, and twelve and one-half inches wide.

There are some iron gratings which give satisfaction, in which case the trench is made to hold three or four days' or a week's droppings, so that they are only cleaned once or twice a week. There are no disagreeable odors coming from this accumulation of manure, the trench being ventilated as shown. All the warm, offensive air is drawn off, and by the use of a daily sprinkling of land plaster (see chapter on land plaster, page 25) as an absorbent, the stable is kept as pure and wholesome as a well-constructed closet in a private house. Where land plaster cannot be obtained, road dust or dry muck as an absorbent is, we are told, the next best thing to procure. If it is desirable to clean the stables not oftener than once a week, the manure trench should be at least eighteen inches deep and eighteen inches wide, in which case, it will, of course, require to have an iron grating behind the cows. I have never had practical experience with these iron grates, but, from what I have seen, they could be improved upon by making the opening between the bars wider, and the bars themselves narrower and deeper, so that the manure in falling will go

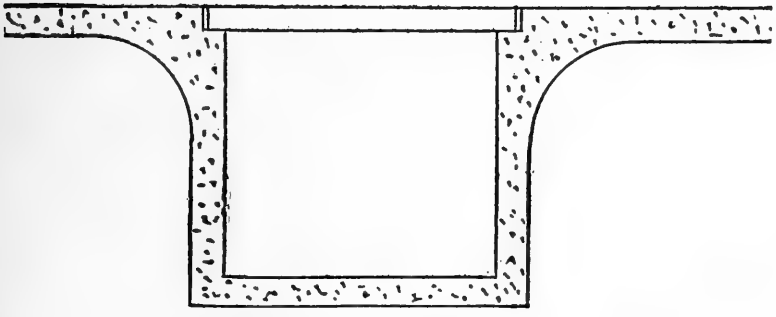
through. As usually constructed, the manure, unless thin, lodges on the bars. Cast-iron gratings are recommended, not to exceed one-fourth inch in thickness by one inch and a half in depth (the nar-



Cast Iron Grating.



Section.



Section of Drop.
18" x 18"

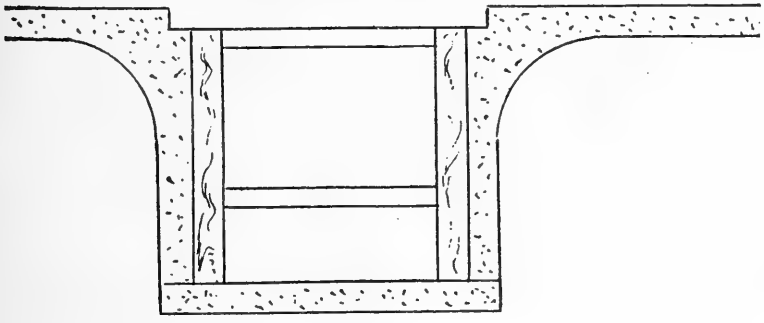
row edge up) the upper edge rounding, and the bars reduced to one-fourth at the under edge, as shown.

Some recommend flat one-inch steel bars set on edge, the bars three-eighths of an inch thick, and running lengthwise of the drop instead of crossways, as shown. Prof. E. W. Stewart, of Lake View, Erie County, N. Y. (author of a very valuable work on feeding animals), first introduced these "self-cleaning stables." He (Mr. Stewart) recommends grating of T-shaped steel bars, made in sections for the width of two or three cows; as to size of trench, he says, in a circular describing these grates, usually sixteen to twenty-four inches deep, three feet wide. If built thus, this will hold droppings of a large cow for about four weeks. He adds, in substance, that stables thus provided are kept sweet, or much freer from disagreeable odors, than where the stalls are cleaned every day. He also recommends these stalls for pig-pens. There is, Mr. Stewart informs me, no patent on this appliance. Mr. James Forsyth, of Owego, has cast-iron grates behind his cows, with a trench large enough to hold droppings for a week, and I was never in a barn so free from the smell of manure. Mr. Forsyth speaks in very high terms of this system of handling manure as a labor-saving device; especially when the manure is to be carted to the field in a manure-spreader, it has very much to recommend it.

The trench itself had better be either of brick or cement, or cast iron, or, if built of wood, should be carefully put together with red-lead joints, or in

some way made water-tight. We can no longer afford to waste the most valuable half of barn manure. This drop or gutter may drain into the liquid-manure cistern, have a hose turned into it, and be thoroughly cleaned after emptying. The gutter is easily made of concrete; first the bottom in the usual way; the sides are made by filling in a space between two planks set on edge as shown below, well supported to keep from springing.

The ditch is dug two or three inches wider than this space between the sides of the ditch and the upright plank (which plank is only used as a mold to



be taken away when the concrete has set). The floor upon which the cows stand is also cemented. This is a little more expensive than plank, but, once in, it should last indefinitely. Depressions for a cast-iron grating to fit in level or flush with the platform the cows stand upon and the driveway behind them, should be provided.

Manure Shed.

Where and when it is impracticable to deliver the manure directly from the wagon or manure-spreader to the field, it is quite essential that some provision should be made either to compost or cover it.

A very inexpensive manure shed on a grain farm may be built by setting some large posts in the ground where the straw-stack is usually built. Saw the tops of the posts off level, and on them place timbers flattened on both sides, and on these timbers place poles, old rails, or boards, and on top of this build the straw stack. I had such a manure shed at my Maple Lane farm, and found it a great convenience, as it made also a splendid place to turn the cows in weather too bad for them to be outside. Three men cut the necessary timbers in my own woods, and completed the work in three days. It was about one hundred feet by eighty feet. The posts were sixteen to eighteen inches in diameter, and set about three feet deep in the ground. It answered the purpose beautifully, and I would never want to be without such an arrangement on a grain farm. Professor Roberts, of the Cornell University, tells us that the waste in manure in an open barnyard is from forty to sixty per cent.

If there is a stone-wall basement under your barn, it can be utilized to good advantage as a manure-shed, for that is really, in my judgment, the best use for a basement of this kind. The principal expense for such a shed is the roof. I have had con-

siderable experience in the different kinds of roofing, and the best and cheapest I know of is to build them of boards grooved and battened, the battens also grooved, as shown in the illustration.

Roof Boards.

At Squawkie Hill, my present farm, I have forty-two box stalls for brood mares and colts, and a covered enclosure, 22 by 120 feet, that was roofed in this way in 1885, and is to-day (1900) in first-class condition, and decidedly better than most of the shingle roofs put on other buildings at the same time. It has had but two coats of iron ore paint during the time, looks well, and answers the purpose beautifully.

Liquid Manure.

On the islands of Jersey and Guernsey, where the science of agriculture is better understood than anywhere in the world, the farmer, whatever else he possesses, is sure to have a liquid-manure cistern. He thinks he cannot farm it without liquid manure, and he is quite right. In the States we invariably let all the liquid manure go to waste, and in its place pay out annually (in the State of New York) over $6,000,000 for commercial fertilizer, as already shown; when if the liquid manure of the farms through the State, that now goes to waste, was

saved, it would probably be worth as much to the farmers as the commercial fertilizer they now annually purchase. It is strongly recommended to every farmer to try and arrange some sort of cistern for this valuable fertilizer, just outside the barn, where the liquid from horses and cattle and the drain of the barn could be saved. There are any quantity of patent liquid manure-spreaders in England, and there will be plenty of them in this country, when there is a demand. The Channel Islanders mostly pump it into a hogshead on a two-wheel cart, and pull a plug to let it discharge into a wooden box, about 4 by 6 inches square, at the rear of the wagon. This box is bored full of small holes on the back side. After what I have witnessed on the islands of Jersey and Guernsey, I would never again attempt to farm without a liquid-manure cistern.

The Mangers.

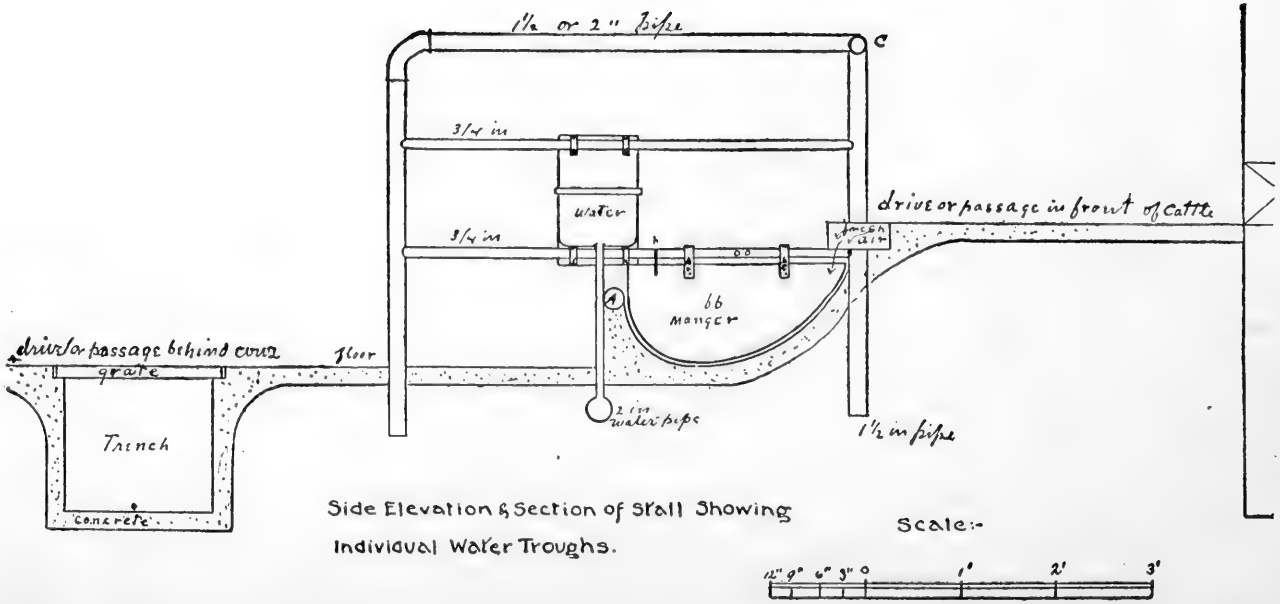
My experience with cattle mangers has been varied. The requirements are, first, something that can be easily, and quickly, and thoroughly cleaned; second, there must be no corners or partitions between cows to accumulate dirt or grain that in time becomes filth. The cows, we have shown, require plenty of pure, fresh air, and we must see that there is nothing accumulating under their noses to defeat that end. The most serviceable manger is one built entirely of concrete and cement, or, if made of wood, it must be so constructed as to make the joints water-

tight. If there is any place in the barn that should be kept scrupulously clean, it is the mangers in front of the cows, over which they must breathe for the greater part of their lives.

All the partitions that are needed between cattle is one just large enough to keep them from hooking each other, or getting at each other's allowance of food.

The cattle always show to best advantage in barns with the least possible amount of woodwork between them. Twenty years' experience in exhibiting cattle at fairs has taught me that the most effective display is made in a tent where the cattle are simply tied to a 2 × 4 rail fastened to stakes driven in the ground, and the rail being about a foot above the ground, with no partition or anything between them or about them in any way. In order to economize room in stables and stand the cattle closer together, some little barrier or partition dividing the stalls is necessary. The partitions are three feet six inches apart. If four feet can be given to each cow, they will require no partition whatever, if fastened by a halter, or as described further on.

In the illustration on page 130 will be found my idea of stall and manger with partitions. The partitions are made of one and one-half and three-quarter inch galvanized gas pipe as shown, the ends imbedded in cement. A three-quarter inch pipe at *c* braces the partitions sideways. Hanging to the pipe *oo* is a board *bb* that separates the mangers, but does not quite touch the bottom of the manger,



Side Elevation & Section of Stall Showing Individual Water Troughs.

and in cleaning out the latter may be swung to one side, either at right angles to the position shown, or removed entirely by unhanging it, thus making a clear passage from one end of the stable to the other, which is thus easily flushed and cleaned by turning on a hose. These feed-box partitions are held stationary by a simple fastening, as shown at *h*. A two-inch galvanized gas pipe forms the top of manger. The floor on which the cattle stand may be thoroughly cleaned with the greatest of ease, and no place is left to accumulate filth.

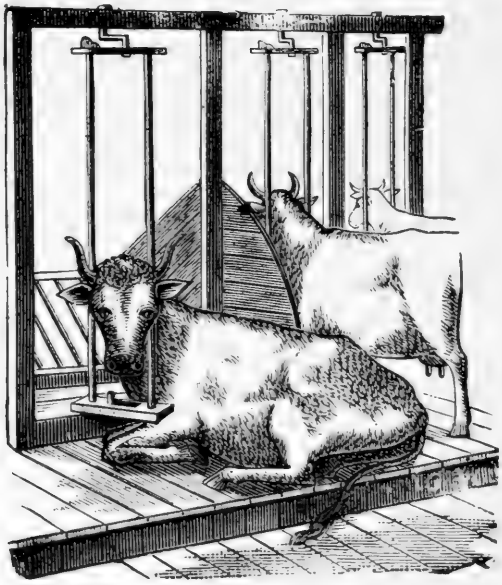
The platform on which the cows stand is also made of cement, or boards, or plank laid in cement. There should be no air space under the floor to collect dampness and rot the timbers. The distance from manger to drop, without grating, for ordinary sized cows, should begin at four feet six or eight inches at one end of the stable, and may be reduced to four feet at the other end, and then place the cows according to their size or length. With an iron grating over the drop, the platform should be made about six inches shorter, so as to bring the hind feet of the cow onto the grating.

Cattle Ties.

Where economy of space is required, stanchions (which should always be the swinging kind—see illustration) enable the cattle to be put in stalls about three feet apart from centre to centre.

But where pure-bred animals are kept, and it is desirous to make as favorable a display of them in

the barn as possible, the stanchions are not the thing. They hide the cattle too much, and they must be given a little more space, *i.e.*, three feet six



The Swinging Stanchion.

inches; in which case there is no simpler tie than a strap about the neck, which is fastened by a short chain to the middle of the manger. (See illustration).

This fastening may be so arranged as to liberate the whole row at once, if it is desirable to do so, by simply pulling on a lever, operating an iron rod that runs the entire length of the stalls through the 2-inch iron pipe that forms the top of the manger next to the cow. The next best tie is a common web halter.

Whatever kind of tie you decide upon, get a noiseless one. There are some fairly good patent ties. I have had most of them on trial, but they are either a weight on the cow's neck, and make a lot of noise, or take too much room. The trap is noiseless, light, and gives the greatest amount of freedom. I say noiseless; the short chain rattles a little, but a rope may be substituted, or the chain covered with leather.

CHAPTER XII.

STABLE MANAGEMENT.

Stable Management in Winter.

In the winter time the cows are kept in nights, and turned out during the daytime, when the weather is favorable. I protest against the principle of keeping cows in the stable all winter without going out, as is being advocated by some. The argument is that cold requires extra fuel (feed), and that exercise also is at the expense of extra feed, and that a cow can only consume and assimilate so much food in twenty-four hours, and if she expends it in additional heat to keep the body warm, or in replacing the wasted tissues or muscles by exercise, she will have just so much less fuel to convert into milk and butter. This is undoubtedly true, theoretically at least. But unfortunately this is not the whole truth. While a cow is a machine, as has been said, she is not an iron machine. They should most certainly be turned out every day during the winter that the weather is suitable, as an appetizer, an invigorator, and for the relaxation of certain muscles. But while it may cost a few pounds of milk in the daily yield, for the year it will, I am sure, be enough greater to make up any temporary loss. It must be borne

in mind that, while a cow is a machine, she is not a finished machine. She is constantly rebuilding and repairing her body, not only in one part or particular, but the whole system is being constantly overhauled and renewed.

That a herd of cattle may be collected and put in the barn, and fed there for six months or a year, without stepping a foot outside, summer or winter, can be done, and that the owner will not be liable to see any bad effects to the cattle themselves, is a fact possibly true; but it is only a question of a few years when that man will discover his mistake. The reader's attention is called to the Havemeyer herd, one of the prominent dairy herds in this country. This herd was fed continuously in the barn until the mistake was discovered, necessitating a decided outcross with animals of stamina and more robust constitution. If, therefore, you have any respect for the future generations and would breed to improvement, give your dairy cows and growing dairy calves all the outdoor exercise they require in suitable weather. If the weather is bad for a week, keep them in for a week. Don't be a crank and drive them out in weather foul and fair. A cow is a machine, but the strength of the machinery is dependent upon health, and the ability to eat depends upon an appetite. Whatever you can do to keep up her energies and stimulate her appetite will be found the surest, safest, and, in the long run, the wisest and most economical course to pursue.

Stable Management in Summer.

The stable management for summer is just the reverse of the winter method, *i.e.*, during summer, as soon as fly time begins, that is, June 1st, or before, the windows of the barn should be darkened, the cattle kept in all day, and turned out in an orchard or a small enclosure nights after milking, and admitted to the barn early next morning. During the night the barn doors may be left open, but they should be closed as soon as the cattle enter and kept closed all day as much as possible. You will find with the outside walls built as described, with two air spaces, that when the cool night air is shut in the barn the heat of the sun will have no effect upon it, except from the fresh air that afterward enters through the flues. This will not make much impression, as all the woodwork and floors are thoroughly cooled during the night, and will remain so to a great extent all day.

We have now shown the advantages of soiling and the most convenient barn construction for pursuing the system most economically. We may now turn our attention to the best crops for soiling.

CHAPTER XIII.

SOILING CROPS.

The different crops that may be used to advantage may be selected from the following list by the soiler, with reference to the nature of his soil, climate, and the condition of his farm, and the kind of stock soiled.

I have noticed only those that have come into general use, and with which I have had personal experience, unless otherwise stated. Rye, followed by wheat (sown in the fall), followed by spring sowings of oats and peas, and these by sweet corn and sorghum, with millet, crimson clover, and barley to carry the stock through to ensilage.

Rye.

There is probably no other plant grown for soiling which furnishes such an abundance of food early in the season. It occupies the ground when no other crop except wheat will grow. It is less sensitive to cold than wheat, and its vegetation is more rapid. It may also be cultivated longer on the same soil than any other crop of cereals, as it is far less exhaustive to the soil. It will produce a fair yield where wheat will not pay the expense of growing.

The land plowed early in the spring for oats, and peas, and corn, and sorghum, should all be sown to rye the fall before, and top-dressed during the winter. It is much better that the soil should be bearing a crop, even if very late sown, so late that it does not even come up, than to remain fallow all winter, especially where the practice is to top-dress in the winter, which method has given me the best results of any, so far as the application of barnyard manure is concerned. Sow two bushels per acre.

Wheat.

In some respects wheat is a better soiling crop than rye. It may be fed longer, that is to say, when it is more mature than rye. Rye is fit to cut earlier, therefore has that advantage, as well as the other good qualities already mentioned. But its fault, its only fault, I might say, is that soon after heading it becomes tough. An acre of wheat sown early to follow rye is a most excellent practice, and will come in handy between rye and oats and peas.

The beardless varieties are preferable. Sow two bushels per acre.

Barley.

Barley makes a most excellent soiling crop, and in a cold backward spring had better be put in for the first spring sowing with peas, as it will stand more cold and grow at a lower temperature than oats.

Barley as a soiling crop is well relished by cattle.

Barley and peas on rich land make a most desirable soiling crop.

It is also one of the best late soiling crops for October, sown after the first cutting of oats and peas, for the reason above given, that it stands quite a frost, and keeps on growing when oats and corn find it too cold. Mr. A. W. Cheever, of the "New England Farmer," says: "Two years' experience with barley for cutting in September, October, and November shows that it is very valuable for late fall feeding, as it is not much injured by frosts. Some of my neighbors have been cutting it this season, even after the ground was frozen." For this purpose, the six-rowed barley is said to withstand the cold better than the two-rowed variety. Says Mr. Flint ("Grasses and Forage Plants"), "It has passed into a regular six-rowed variety, which is a winter grain, and endures more severe cold."

Sow with common Canadian field peas, three bushels per acre, half and half.

Oats and Peas.

When it comes to a question of the very best soiling ration for producing the greatest flow of milk, there is no forage crop that, in my experience, exceeds oats and peas.

Sow as early in the spring as the ground will permit, and begin cutting when the oats are heading, and the peas have well-grown pods. Sow equal parts, and three bushels per acre. My practice has

always been to put it in with a common grain drill, but some advocate putting the peas in deep and broadcasting the oats. I cannot say as to this. I always had great success putting them in together with the drill, making one job of it. I do not see how it is possible to produce any better results than I have attained by this method.

Oats and peas are a most excellent soiling crop for ewes when suckling their lambs, and when it is desirable to crowd the lambs for the butcher, they will be found a most excellent assistant. Brood mares with foal at foot can have no better treatment than to be put into the barn daytimes, and fed a liberal supply of oats and peas. I am in favor of it for work-horses, if they must have green food. Of course, there is nothing better than good timothy hay and oats for a horse to work on, but oats and peas may be fed without loosening the bowels, as is often the case with grass or clover. Lucern, however, is, no doubt, quite equal to oats and peas for feeding horses. In feeding oats and peas to work horses, I prefer them well advanced, that is to say, the heads well formed, and the peas old enough for table purpose, or a little beyond that stage. In a letter from Mr. Crozier, of Long Island, after mentioning several of the leading crops that he uses for soiling, he says, "I also grow that most valuable crop for soiling, oats and peas, one of the best crops I grow."

Mr. T. Brown, in an article in "The Country Gentleman," gives it as his experience that oats cut and

fed green will produce the most milk of all green crops, and will be the greatest profit to the cheese factory. For my own part I look upon oats and peas as the staple soiling crop. Of course, later in the season we must resort to corn and sorghum in most parts of the United States, as these crops grow and thrive better in hot weather, and in time of drought.

Iowa Bulletin, Number 19, 1892,

Reports that up to this time they have had most success with oats and peas. Recommend one and one-half bushels of oats and one and three-fourths bushels of peas per acre. The peas are sown broadcast and cultivated both ways. Then the oats are sown broadcast and harrowed each way. Work began April 10th and cut July 7th. The three best varieties of peas were:

	Weighed Green.	Cured.
Rennie's No. 10	14.2	5.5
Greenfield	14 2	4.2
Egyptian	13.2	3.6

It further says that peas and oats cut in this stage form one of the richest foods, especially in protein and fat.

Corn.

For soiling purposes the smaller growing varieties are quite large enough. My personal experience has been mostly with Stowell's Evergreen and "Sou

Fodder" and common Northern varieties of field corn. The principal advantage in selecting the

smaller varieties is that they are more convenient to handle, and more suitable for feeding whole in the cattle's mangers.

Within the last few years the introduction of machines for the special purpose of harvesting standing corn and ensilage fodder has placed in the hands of the dairyman a most valuable and labor-saving device, which can be heartily recommended to any one soiling their cattle, when the number of animals soiled will warrant the outlay.

There is a variety of fodder used in the West that, from its description, should make a valuable variety of soiling, *i.e.*, the Pearl Flint variety. It is said to set from three to six ears to stalk, with medium growth stalk. Sow from one to one and one-half bushels per acre. It should be sown thicker than for ensilage.

The most convenient way of planting is with a grain drill rigged to drop a kernel every four to six inches, and in rows from twenty-eight to thirty-five inches apart. That is, providing the drills of the seeder are the usual width, that is, seven inches. If eight inches, the rows should be twenty-seven or thirty-two inches apart. If a drill is not geared to drop the required number by allowing one tube to run, two or three feeds can be run into one of the cast shoes by simply taking the rubber tubes from their respective shoes, and letting them discharge into one shoe or drill. An eleven-hoed drill is the most convenient for this purpose, and usually the proper gearing can be had to sow the desired amount from the discharge of single tubes. In an eleven-hoed drill, let Nos. 2, 6, and 10 drills discharge. This will plant three rows at a

time, twenty-eight inches apart. If it is thought best to plant thirty-five inchesa part, let Nos. 3 and 8 discharge; in each case the wheel of the drill will answer for a guide in the return bout. When sown broadcast, the leaves stop short of full development, the stalk is weak, and liable to be thrown down by storms, and has not the strength to right itself. It is hardly necessary to add that the ground should be well manured and cultivated. Mr. Harris Lewis says that he has found Stowell's Evergreen sweet corn makes the richest milk of all the plants he has tried.

Sorghum.

My experience in growing sorghum for a soiling crop has been so satisfactory that I can heartily recommend it to any one wishing to try it. It has but a single fault. It is slow at starting. In 1878 several farmers, including myself, became interested in the question of growing sugar cane (sorghum) which we had made into syrup. I had planted about an acre, but it did not seem to germinate, and I bought seed for as much more. To my surprise the former planting came on all right, and I had twice as much as I cared to have made into syrup, and the result was that we tried it as a soiling crop, and found that the cows not only ate it with great relish, but that they made a slight increase in the flow of milk. Subsequently I made a practice of sowing it yearly, and have strongly ad-

vocated its use ever since. I have seen it claimed that three and four cuttings could be made from the one seeding in a season, but I have never been able to obtain more than two, and the last two years I used this second growth to plow under, sowing the ground to rye for the next spring's crop. This, I believe, is one of the advantages of the crop, that the seed grows the first crop for the cattle and the second crop for the land the same season, followed by rye for the first cutting next spring. This gives two soiling crops and one green manure crop upon the same land in a single season. Sorghum, when once established, will flourish during a drought in which corn comes to a standstill. Some recommend drilling it in with corn, or in alternate rows with corn. I should think this would be a very good idea.

It is possible, no doubt, that in the Southern States, where the seasons are longer, and where land is in a high state of cultivation, it might produce two crops or even three as claimed; and as it is a comparatively new soiling forage, I submit the following reports from experimental stations and from newspaper articles on the subject. Sow in drills to cultivate same as corn, as it starts slowly. It is better to plant on sod, thus preventing weeds getting the start of it.

Sorghum Reports.

Georgia Bulletin, Number 13, 1891.

"This class of plants, as shown by the analysis, is highly nutritious. Three or four cuttings can be obtained during one season, outyielding almost any other forage plant. The seed, of which the stock produces an abundance, compares favorably with corn as a food. The sorghum will stand a dryer season than the corn. When corn rolls or the plants are drooping or standing still, the sorghums are little affected, but continue to grow and yield good returns in fodder and grain, so that they are even more reliable as a soiling crop than corn. They are greatly relished by all farm animals, green or cured; and it is claimed that the milk and butter as well are improved in quality and quantity when fed to milch cows. A little more care should be exercised in attempting to cure sorghum than corn, as it heats easily when in too large shocks. The best plan is to cut it, and let it lay on the ground and wilt, tying in small bundles and shocking it by setting the bundles so as to support each other like shocks of wheat.

"It is sown in drills and cultivated the same way as corn. The first cutting should be done before the stalk flowers. It should be thoroughly cultivated between each cutting. Level culture is best, in drills or hills, the same as corn. Animals prefer

sorghum to any other article of forage diet. Considering its ability to grow in the hottest and driest weather, and that three and four cuttings with one planting can be obtained on rich land, there is no plant for soiling which can equal or surpass sorghum in the production of milk. Yellow orange is given as the best sorghum, containing the largest proportion of dry matter per acre."

	First Cutting.		Second Cutting.		Third Cutting.		Total.	
	Green.	Dry.	Green.	Dry.	Green.	Dry.	Green.	Dry.
Link's hybrid.....	22,464	2,579	13,728	1,996	8,320	1,664	44,512	6,239
Early orange.....	18,760	2,392	10,054	1,788	7,072	1,289	37,336	5,169
White Milo.....	18,928	2,204	16,640	2,704	16,224	2,579	51,792	7,487
Bennett's prolific....	24,960	7,072						
Brazilian.....	23,472	6,489						

Starts slowly.

Kansas Bulletin, Number 18, 1890, page 175.

"The problem is complicated in Kansas by the uncertainty of rainfall, and by its unequal distribution. Corn is the universal forage plant in the West, and in good seasons it is doubtful if anything better can be grown, but for the greater part of Kansas it is too uncertain to be depended upon to furnish the necessary forage, owing to drought in July and August, and uncommonly early killing frosts."

Non-Saccharine Sorghums.

This class of sorghums is, as a rule, a generous grower, producing in good seasons a heavy yield of leafy and palatable feed, which compares very favorably with corn fodder. In dry seasons these sorghums have the advantage over corn that they are not affected by drought to the same degree. In continued dry weather, they will remain nearly stationary, but when rain does come they again pick up and push ahead vigorously, whereas corn, when once stunted, never recovers. They will also make a better growth on poor land than corn can do, and under the combination of a dry season and on poor land, where corn will be a complete failure, these sorghums may still give a fair crop.

The non-saccharine sorghums are as a class heavy yielders of seeds, and the seeds compare very favorably with corn in its composition and feeding properties.

Plant in drills; cultivate same as corn, three feet apart in rows.

Kansas Bulletin, Number 18.

"Corn and sorghum, in alternate rows and in the same row, gave best results in the latter case. The theory is that plants with different habits of growth and feeding powers produce a heavier growth by planting together than separately."

Arizona.

Sorghum and alfalfa supplement each other, each supplying what the other lacks to make a good cattle food.

Eds. Country Gentleman: In the suggestion to W. L., page 206, who wishes to try soiling, there is nothing said about sorghum, and yet it is without question the best soiling crop, yielding food rich and palatable and which can be cut in two months from sowing the seed, and is in its prime in less than three months. It has the property of enduring drought beyond any valuable plant that I am acquainted with, and it is eaten absolutely without waste. Besides, it has so much the nature of grass that its quality is not impaired by thick planting, as is corn. If W. L. will try a plat of it this year I predict that he will never go through a summer again without it. When you find a crop that will furnish full feed for six cows a day from a square rod, you will realize the value of soiling crops; and I have done this with sorghum repeatedly, grown without any cultivation. W. F. Brown.

Kaffir Corn (Non-Saccharine Sorghum).

We have read more or less concerning this variety of forage, and I have taken considerable pains to ascertain its real value compared with Stowell's Evergreen and sorghum. It is a corn with similar habits to the saccharine sorghums. The following article appeared in the "Breeder's Gazette," and as it produces such strong evidence of the value of Kaffir corn, I publish as much of the article as pertains to its value as a soiling crop:

KAFFIR CORN AS A SUBSTITUTE FOR INDIAN CORN.

"The saccharine sorghums, after being subjected to thorough tests through a long series of years, have been accorded a high place among the forage plants of America. In one respect, however, the sugar sorghums did not meet the requirements of the central and western trans-Missouri country. The requirements were these:

"1. A plant with great drought-resisting powers.

"2. A plant cheaply grown, cheaply harvested, cheaply cured, and cheaply fed.

"3. A plant which would be practically a substitute for corn in the production and value of grain.

"The sugar sorghums meet all these requirements except the last. As a purely forage plant it stands without a rival.

"What is needed in the trans-Missouri country, in addition to the sweet sorghums, is a plant which has all the staying qualities of the former, but which exerts its energies in the production of grain high in quality and quantity. Such a plant would come nearer a substitute for Indian corn than the sugar sorghums, and the two together would supplement each other, and combined would meet all the requirements for feed in the trans-Missouri country. This kind of a plant Kansas farmers believe they have discovered in Kaffir corn.

"Kaffir corn is one of the many varieties of the

non-saccharine sorghums, and one which has forced its way to the front and scored a decided victory over all other members of the same family. Its chief competitors for supremacy were rice corn, Milo maize, and Jerusalem corn. After a fair and thorough test at the Kansas Agricultural Experiment Station, and on the great experimental grounds of Central and Western Kansas, over a period of fifteen years or more, all competitors practically withdrew from the field, and Kaffir corn wears the laurels. The more farmers become acquainted with it and with the manner of its behavior in times of a crisis, the more they appreciate its high qualities. Here is an object-lesson given on my own farm: It was necessary last spring to replant a portion of the area planted to corn, which was done about May 20th. About the same time fourteen acres of Kaffir corn were planted. The late-planted corn was practically ruined by the excessive heat the latter part of August, while the Kaffir went through practically unscathed and yields over thirty bushels per acre. In times of heat and drought it bravely holds up its head, and for the time being it stands still. With its beautiful green foliage it seems to defy the unmerciful fiends in the red-hot air, and when King Sol begins to relent, and gracious showers fall, it moves serenely on as though nothing had happened. Such is Kaffir corn, and these are the qualities which commend it to the trans-Missouri farmer."

Millet.

This is doubtless one of the most nutritious green forage plants that is used in soiling cattle, as may be seen by reference to the foregoing tables. As a green manure it also ranks first, containing twenty pounds of nitrogen and seventeen pounds of potash to the ton. It germinates and grows very rapidly, and endures drought remarkably well. It is a very leafy plant, and furnishes the most succulent food, which is highly relished by all kinds of stock. It is said to flourish in somewhat higher and dryer soil than other grasses, but it attains greatest luxuriance in soil of medium constancy and well manured. It is usually sown broadcast, requiring one bushel of seed per acre, or grown as hay, which can be done after a soiling crop of rye, oats, or peas. It makes one of the best rations according to analysis to feed in connection with ensilage for a winter feed that can be mentioned. I have grown it several times as hay in this manner, and like it very much. Another advantage, and by no means a small consideration, is that it is such a grand substitute for hay, and can be grown on the same ground after a crop of hay the same season, or, as above stated, after a spring or early summer soiling crop, and then followed by a crop of rye. The same land that will produce one ton of hay per acre will produce at least three tons of millet, and in a favorable sea-

son and on good, rich soil, a much larger yield. The best crop of millet I ever raised was after a crop of clover, and when the hay was gone we substituted millet for the noon ration, with ensilage morning and night. To my surprise the cows did equally as well on it as on the clover hay, and it produced twice as much feed per acre as the clover. I have also grown some grand crops of millet after oats and peas, simply cultivating the ground and sowing the seed, harrowing, etc. It wants to be cut before the heads are in "the dough." When allowed to stand until the seeds are fully ripened, the stalks are rather tough and woody. It may be sown as late as July. One bushel of seed per acre, broadcast, and harrowed and rolled.

Clover.

The principal reason why clover has not been more extensively used as a soiling crop is that, while it is very valuable, there are other crops used instead, which produce two, four, or six times as much per acre, and yet are not so valuable for hay. It is much cheaper to cut the feed for fourteen cows from five or six rods per day, than to cut it from ten, twenty, or thirty rods. "One acre of clover," says Mr. H. Lewis, "will feed a dairy of forty-five cows fifteen days," and he adds that three acres furnishes his herd of thirty-eight cows by soiling five weeks. Mr. E. W. Stewart says: "Desiring to know the feeding capacity of an acre of clover, I measured off forty square rods, and I began feeding

it to seven cows and five horses. To my surprise it fed them fifteen days, equal to feeding one cow 180 days. The two succeeding years I tried the same experiment, feeding only cows, one of which proved equal to feeding one cow 170 days, the other 165."

Lucern or Alfalfa.

My experience with growing lucern was at first most discouraging, and, finally, most satisfactory. In 1877 I made a trial of an eighth of an acre with another crop on land near the barn, but it turned out to be such a foul piece of land, and the weeds were so much in the majority, that in the last of July I sowed the piece to buckwheat to subdue the weeds. I found it a shy plant at starting, and that on this account I had made a great mistake in plowing in the spring and top dressing with stable manure, which itself was, no doubt, full of weed seeds. I was determined, however, to have a patch of lucern. I cultivated the lucern patch and sowed it to buckwheat, increasing the amount of land to an acre. The buckwheat came on well and did the weeding thoroughly. That fall I plowed as deep as possible, deeper than ever before, and sowed the piece to rye. This rye crop I plowed under in the following spring, and fitted the ground with great care by cultivating and harrowing, until I had a seed-bed fit for a garden, and sowed twenty pounds of good fresh seed per acre. I felt certain that only a small portion of my first seeding germinated. Here, I be-

lieve, has been a source of discouragement to many others in attempting to raise lucern. Dealers in the Eastern States had little call for it at that time, and still, for that matter, they order a few bags at a time. This time I sowed the seed with a light seeding of barley, and cut the barley for a soiling crop. The lucern was just at a stage where it came on with a rush, and my seeding was a success. I never weighed the amount per acre, as I have often wished I had, but the second year I obtained three cuttings from it. That, I am sure, gave me more forage than from any other acre I ever had in soiling crops. The soil was a deep gravelly loam.

Lucern is somewhat more difficult to cure than clover. But as a soiling crop to feed in connection with corn, it has no superior. Corn, as will be seen on page 12, is very deficient in albuminoids, and requires bran, shorts, pea meal, linseed, or cotton-seed meal to supply the deficiency; but green corn or ensilage, fed with lucern or Hungarian millet, makes a good ration. The two fed together make the most desirable combination that can be grown. Its ability to withstand great drought, owing to the great depth to which its roots go for food, and its tremendous yield per acre of most succulent and nutritious forage, make it second to none as a soiling crop. One seeding will last for years. It is a crop that answers well to liquid manure.

Where land is suitable for it, it should be given the first place in the list of soiling crops. It is fit to cut in the spring, nearly as soon as rye.

Requirements:

1. Fresh, clean seed.

2. Thorough preparation of soil after buckwheat or a hoed crop, and a well pulverized seed bed.

3. Any soil with porous subsoil, which must be so open and so located as not to have standing water either on top or in subsoil. With these requisites and a good start success is assured. I am so sanguine of its proving a success under the above conditions that I quote at length the following, confirming my own experience, and showing even much better results:

Alfalfa or Lucern.

United States Bulletin.

"Grows in every State in the Union where conditions of the soil are favorable. As a soiling crop, it has no superior. From three to four cuttings a year can be obtained.

"It is not a new plant by any means. A native of Western Asia, and, says Jared G. Smith in *United States Bulletin* No. 31, was introduced into Greece at the time of the Persian war, about 470 B.C. From Italy it was introduced into Spain and the south of France. It was carried into Mexico at the time of the Spanish invasion, and thence to the west coast of South America. It was brought from Chili to California in 1854, and from there it rapidly spread over the arid regions of the Pacific Coast and the

Rocky Mountains, where it is now cultivated almost to the exclusion of other forage plants.

"Alfalfa is a deep feeder. The tap roots descend to great depths wherever the soil is loose and permeable, often averaging ten to twelve feet. It has been recorded as sending its roots to the depth of fifty and sixty-six feet.

"When the stems are cut or grazed off, the stalk dies down to the very base, and new buds spring up on the upper part of the crown of the new root and grow, forming new stems. This method of growing explains why so many farmers have reported that alfalfa is injured or destroyed by continuous close grazing. Prime condition for success is that the land be well drained. Twenty to twenty-five pounds of seed per acre broadcast. Fifteen to twenty pounds in drills."

Nebraska Reports, 1, 1892. Article IX.

"In the fall of 1892, during the prolonged and severe drought, it was the only green plant of the whole list, notwithstanding the fact that the spring was very dry. It grew nicely, and during the year made growth as follows:

1892—First cutting, twenty-six inches, June 29.
Second cutting, twenty-six inches, August 2.
Third cutting, twenty-six inches, September 1.

	Hay, Pounds.	Per Acre.
1893—June clover	473	2,365
Mammoth clover	475	2,375
Alfalfa, first cut	816	4,080

First cutting hay, 816 lb.; second cutting hay, 805 lb.; third cutting hay, 743 lb.; fourth cutting estimated, 180 lb.; a total for one-fifth acre of 2,544 lb., or 12,720 lb. per acre, or six and a half tons of good dry forage.

"What plant can we grow that will, without special care, give greater or even equal returns of good palatable forage?

"It has succeeded in Southern California and Mexico, where it has been a godsend to those people who needed some permanent and reliable forage plant that could withstand prolonged heat and drought. It goes to a great depth in search of moisture. Roots have been known to reach the depth of twenty feet or over. It is a very nitrogenous plant, collecting, it is believed, the nitrogen of the soil through a bacteria that works at the roots, and is ever present in the soil. It is, therefore, a great renovator of the soil, and a great accumulator of the most desirable, most expensive plant food, nitrogen.

"Sown as early as possible after frost. Land should be in excellent condition. Fifteen to twenty pounds of good, fresh seed per acre. That of the previous year's growth should always be obtained if possible. Sow in drills or broadcast. Never sow with another crop expecting good results, or with a very small amount of grain, one-half to one-fourth bushel of oats or rye or wheat per acre. Cut early together with all weeds.

"Keep stock off the field during the first year and first part of the second year. If conditions are fa-

vorable, you should have a fine stand. Tons upon tons are being cured for hay, and are being fed to cattle and to other stock.

"Food Values: The value of any food depends largely upon two substances present in varying quantities. They are the proteins and the nitrogen free extract. The former is a flesh or muscle producer, while the latter is of the fat-producing order.

"Objections: Not easily established. Cannot be pastured first year.

"Advantages: When once established, does not run out. Stands drought better than clover. Grows rapidly, makes muscle rather than fat."

Soiling vs. Pasturing.

United States Report.

"Alfalfa is one of the very best soiling crops. It may be fed in this way to better advantage than if the stock are pastured on the field. Cattle and sheep cannot be safely pastured on alfalfa, particularly when it is young and tender, or after there has been a heavy dew or rain. They are always liable to bloat if fed with green or wet alfalfa. Horses and hogs are not affected in this way. The loss of sheep and cattle from tympanitis, hoven, or bloat, as it is called, is very great every year, and, though a herd may go through an entire season without loss, it is never perfectly safe to permit it to depasture the alfalfa. By a proper arrangement of the feeding pens and corrals alongside or near the field,

the method of soiling—that is, mowing the alfalfa and feeding it in a partially wilted state—is a cheap and perfectly safe one. The additional cost and labor of cutting the crop, and hauling it to the feeding pens, will be less than the loss that will be sustained if several head of stock die of bloat during the season. Young horses will make a very rapid growth if pastured on alfalfa, especially if supplemented by the daily addition of a small feed of oats. One of the disadvantages of depasturing alfalfa is that the soil soon becomes trampled and hard, and for this reason the roots are not able to make a sufficiently strong growth, and the field is sure to deteriorate."

Alfalfa for Hogs.

"One acre of alfalfa will furnish forage for from ten to twenty hogs per season. There is no cheaper or better way of producing pork than to allow growing pigs to run in a field of alfalfa. At a conservative estimate, ten pigs per acre will gain a hundred pounds each during the season from May to September, and 1,000 lb. of pork cannot be produced so cheaply on any other feed. The pigs will come out of the field in autumn in capital condition to fatten with corn or small grain. The alfalfa in a hog pasture should be mowed once or twice during the summer, or whenever it commences to get hard and woody. This will provide plenty of young and tender herbage, which is more nutritious, weight for

weight, than forage from the older plants, and if the swine are provided with this food in its most nutritious condition, their growth will be most rapid. They need to be provided with an abundance of fresh or running water in their pastures. This forage plant responds quickly to manuring; no other fodder plant responds more promptly to extensive cultivation. Yet it is not advisable to apply stable manure when preparing the ground. Such manure is always full of weed and grass seeds that have not been digested, and which are really in better condition to grow than seed scattered naturally in the field."

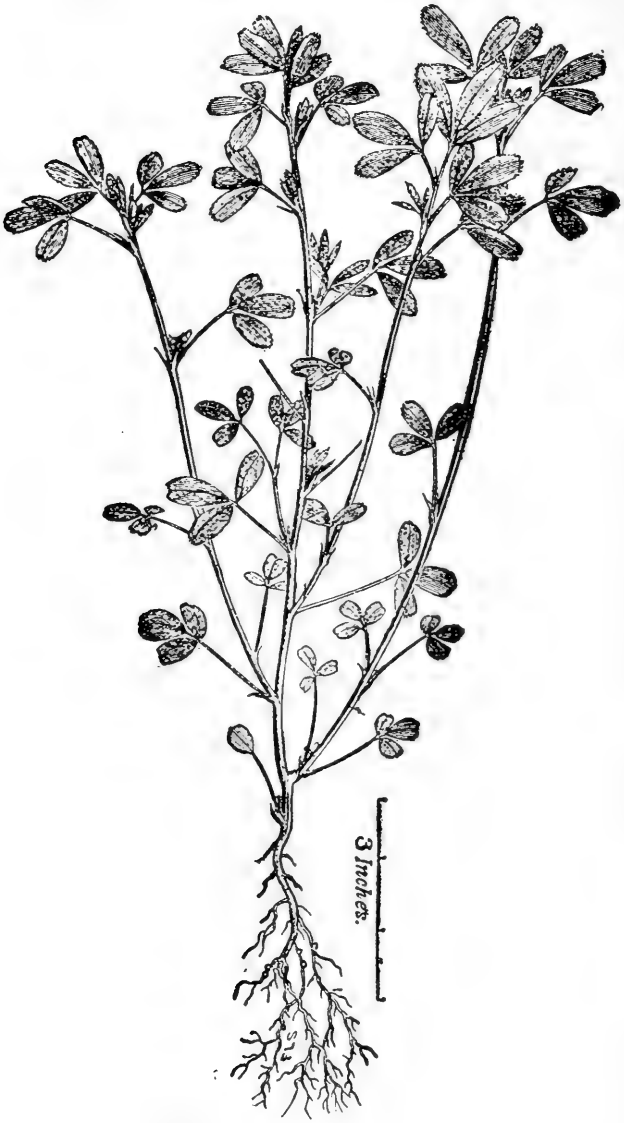
Alfalfa Forage for Milch Cows.

New York Experimental Station, 13th Annual Report.

"The importance of feeding leguminous crops has led to many inquiries concerning the value of alfalfa as forage for milch cows, for the alfalfa is much liked by the cattle and other animals and contains an usually large proportion of nitrogenous constituents. The rapid growth of the plant, which can be cut three times during the season, and often four times, makes it especially worthy of consideration where soiling methods are practised.

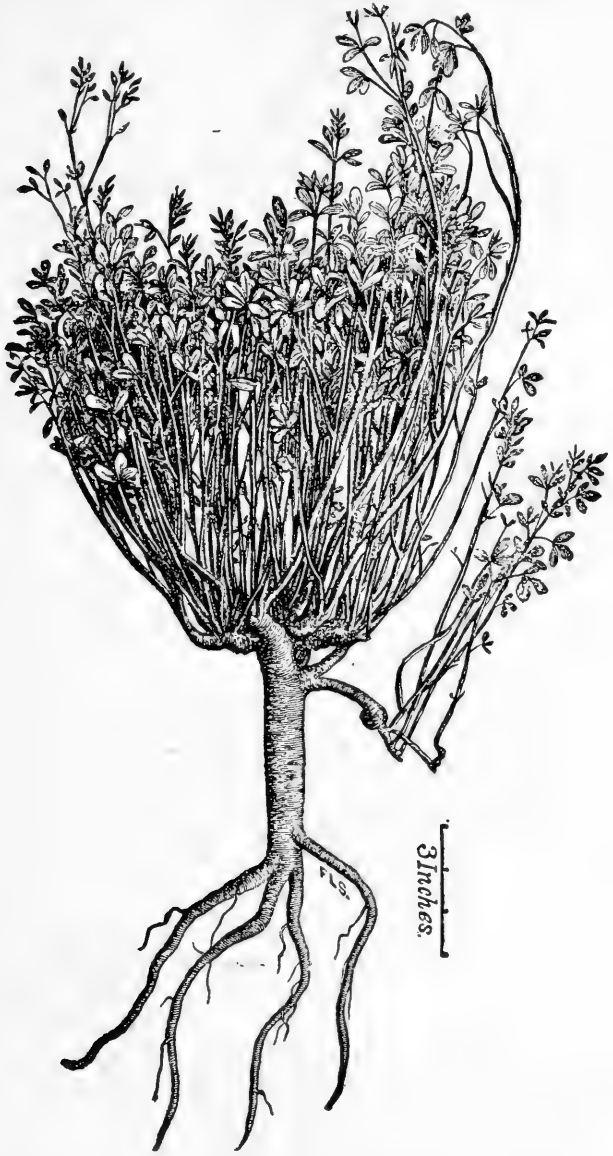
"A few of our farmers have grown good crops of alfalfa successfully for several years, but it does not seem suited to some sections of the State. Alfalfa has grown well on the station farm, although the soil is a rather heavy clay. A field of alfalfa of 2.28

acres, sown in 1890, yielded this season (1894) for the first two cuttings—the first during June, and



Alfalfa Seedling, 6 weeks old.

the second about August 1st—at the rate of 24,500 lb. of green forage per acre. On account of very



Alfalfa, 3 years old.

severe drought, the third cutting was very light, and only part of the field was cut for the fourth time. Another field of alfalfa of 1.3 acres, sown in 1893, yielded at the rate of 38,500 lb. of green forage per acre, as the total for four cuttings. The last two cuttings were very light on account of severe drought. The first two cuttings, from May 1st to 31st, and from July 9th to 29th, yielded at the rate of a little over twelve tons of green forage per acre. These fields had been steadily cropped and not well manured for some years before sowing to alfalfa, and were not in condition to produce heavy crops.

"The palatability of alfalfa or of corn (maize) is greater than that of most other forage plants of rapid growth that yield heavy crops. This is a matter of the greatest importance, for while the milk may be temporarily produced at the expense of loss in the weight of the animal, the flow of milk must be sustained by the food taken in excess of that necessary for maintenance.

"In order to check the growth of weeds, a mowing machine can be run over the field of young alfalfa with the cutting bar raised, so as to avoid cutting near the crowns of the young plants."

Crimson Clover.

My personal experience with crimson clover is limited to two seasons' trials. The first trial was not successful. No doubt it is a most valuable

plant, and that as an autumn soiling crop it is most desirable. Besides its value to the soiler as a forage crop, it is a most excellent crop to follow after the soiling crops up to the middle and end of August, both to feed and to be plowed under for a crop of rye. It is safe to say that $10 worth of crimson clover seed sown in July will, under favorable conditions, grow more fertilizer delivered on the spot than can be bought in any commercial form for $100. The soiler soon learns to take advantage of all these things. It is claimed that in warmer climates than Western New York, it may be sown in the autumn for early spring feeding, and will be ready to cut earlier than red clover.

Our knowledge of its proper use, and the proper way of handling it, needs experience, nothing more. The following is from "The Country Gentleman," written by Mr. G. T. Powell, and gives such practical and valuable information on the subject as follows:

Crimson Clover—How to Use It.

"There has been much discussion over crimson clover, and much condemnation and disappointment in its use in the Northern States. That there is large value in it is beyond all doubt, but the plant must be used right and with knowledge of its requirements.

"There are five known varieties of scarlet clover (Trifolium incarnatum) grown in Europe. These

differ largely in their character of growth, the fifth having a white blossom, and makes but a feeble growth in our climate. There is an Egyptian clover, the seed of which closely resembles the scarlet, and it will not withstand freezing. The seed is imported and many have doubtless purchased it, and failure following, crimson clover is condemned.

"It is an annual, grows best in a cool season, and should be sown only for autumn growth. The object in growing this plant should be to improve the soil by the nitrogen that it will gather from the atmosphere, to keep the soil covered, especially during the winter, save the loss of nitrate, and to add organic matter or humus so much needed in the soil of all our older States.

"For two years we have had nearly seventy acres of crimson clover, with entire success. Ten pounds of seed per acre will make a heavy covering. The seed should be put on all cultivated and autumn gathered crops. We sow with buckwheat freely first. After the buckwheat is cut it grows until winter, making an abundance of plant food for oats the following spring. In the last cultivation of corn and potatoes, about July 10th, the seed is applied and cultivated in. Cultivation in the apple, pear, and cherry orchards is stopped near July 15th. Seed is applied upon all these. Vineyard culture ceases by July 20th, when they are seeded. . . .

"Crimson clover should not be sown in the North with the expectation of its coming through the following spring, while it will o ccasionally, but with

continued freezing and thawing it will be largely killed. . . .

The New Jersey Experiment Station has shown by analysis that 'a crop of this clover six inches high has accumulated nitrogen per acre that would cost $15 to buy; at thirteen inches high, $25.50 to buy per acre, while at full maturity it is worth $30 per acre.'

"The following are some of the points to be kept in mind in sowing crimson clover for the North: Get home-grown seed, not imported, sow early in July, and depend upon growth only up to December. Sow only with the object to improve the soil; sow to keep down weeds, and for a winter covering to the soil. The better the previous cultivation, the greater will be the growth. It is adapted to all kinds of soil, but especially to sandy soil. If the soil is rather poor, apply 250 lb. of muriate of potash per acre to give it a more vigorous start. If farmers will study this plant, and use it judiciously, it will be the cheapest way possible to build up run-down land. Nitrogen, the most expensive plant food, need not be purchased, only potash and phosphoric acid occasionally, thus saving much of the present heavy outlay for commercial fertilizers.

"The possibilities for improvement by the use of crimson clover are far greater than farmers realize. It must not be condemned on one or two trials when red clover has failed in many places for the past twenty years."

Delaware Station, Third Annual Report, page 151.

"An analysis to determine its feeding value compared with wheat bran. It took 5.8 tons of crimson clover green to make one ton air-dry. And one ton air-dry crimson clover gave:

	Crimson Clover.	Wheat Bran.
Crude fat	$6.06	$6.16
Crude proteins	5.86	5.48
Carbohydrates	8.98	8.41
	$20.90	$21.05

"Seed: An average of from nine to ten bushels per acre is not unusual. Clover two tons per acre leaves four tons of roots in the ground."

Cow Peas.

South of the Mason and Dixon line the cow pea is becoming one of the most valuable of plants for soiling, and especially for plowing under for green manure. I have witnessed some of the most marvellous results from plowing under a crop of cow peas in North Carolina. I feel safe in saying that it is a saving of hundreds of thousands of dollars in commercial fertilizers in that State alone; and when thoroughly understood will be an annual saving of millions to the Southern farmer.

It grows even as far north as Lake Ontario. My own experience with it is limited to two trials on very poor, wornout land; and while I was not able to

grow much of a crop, it probably did as well as anything would on that particular ground. Since visiting some enterprising farmers in North Carolina, who are large growers of the plant, I am thoroughly convinced that, for the South at least, there is not at hand another forage crop that can be called its equal. In order to grow the first crop on exhausted land, barnyard manure or commercial fertilizer would be a great assistance. The following extracts in substance are sifted from the *Georgia State Bulletin*, No. 29, 1894:

"It is really not a pea, but a bean. Clover of the South, king of land renovators. More valuable to the Southerner than clover to the Northerner. Draws nitrogen from the atmosphere. Grows on light soil.

Result: The best disposition of the crop was to convert the vines into hay or ensilage. There was little gain in plowing under the whole crop green, or plowing under the stubble. That it stands today at the head of all soil renovators, at least for the South, is beyond question.

"Cow peas will grow on land that is so impoverished that clover will not grow. It has been proved to do well in the North, in Iowa, Illinois, Indiana, and Ohio, and in New York and Connecticut. A crop of 16,000 lb. of green vines per acre is reported from Connecticut. It is certainly worthy of trial as a renovator, even if the seed is yearly obtained from the South. Best for hay or soiling or ensilage are the erect varieties, Unknown, Clay, and Whippoor-

will. Where a dense mass of vines is wanted to remain all winter on the ground, Calico, Gourd, Black, and Constitution are preferable.

"The roots of these plants penetrate deep into the soil, like lucern, drawing their food from beyond the reach of most other plants, keeping the soil porous, and above all their power to assimilate nitrogen, the most costly of all plant foods from the atmosphere (four-fifths of the weight of the air is nitrogen), not through the leaves of the plant, but through the bacteria that have their seat in the root tubercles through which the free, atmospheric nitrogen is assimilated. Nor is this all. The dense foliage prevents the soil from baking. The roots and stubble alone of an acre of average cow peas contain 22.6 lb. of nitrogen, 5.9 lb. phosphoric acid, and 14.5 lb. of potash."

Two bushels per acre is about the amount of seed, usually sown. The beauty of this and the clover crop is that you can take a large crop from the soil, and still leave the soil in better condition than before the crop was taken.

Soja Bean.

Although known in the Southern States for a long time, it has never been fully appreciated, but promises to become a great rival of the cow pea. It produces a great amount of green forage, which seems to cure easier than cow pea vines, and proves more productive of peas. The plants grow erect to the

height of two and one-half to four feet, compact and not spreading, but branching freely, producing numerous wooly pods, containing two to three round yellow beans. It is of as easy culture as our cow peas, yielding a forage which is greatly relished by farm stock, the beans being rich in protein.

Prickly Comfrey.

Vermont Report, 1889, page 87.

"Began cutting May 16th. Four cuttings during the summer. First cutting, May 16th, 15.9 tons per acre. The other three cuttings averaged a little over seven tons per cutting. Generally grown by dividing roots, leaving one-half in the ground, cutting the half taken out into small pieces. A patch set out in early spring was ready for first cutting May 25th."

CHAPTER XIV.

SOILING SHEEP.

The advantages of soiling sheep are becoming more apparent in this country every year. "The flesh and wool of sheep," says Mr. Stewart, "are but the products of the soil, and contain nothing but what has existed in the plants which the sheep have consumed." No farmer who has ever bred sheep for mutton needs to be told of the necessity of supplying an abundance of succulent food for his lambs, until they have reached maturity. A lamb that has been stunted for want of proper nourishment or from sickness can never be fattened as profitably as one whose growth has never been checked. The English farmers not only know this, but take every precaution to prevent it, and to this it is mainly due that they are enabled to export to this country, yearly, many thousand dollars' worth of sheep, while American farmers might breed as good at home if they would feed as well.

But in regard to sheep we have yet much to learn. I mean we have to put into practice what we already know, but for some reason fail to appreciate its importance. There is not a farmer in America who will not say that it costs no more to keep a good

sheep than a poor one; but not one in a hundred puts the statement to proof in practice. The English farmer makes no secret of how he produces a flock of sheep that average 200 lb. each, and shear from twelve to twenty pounds of beautiful wool. It is all explained in the one word, feed. Not grain so much as a never-ceasing supply of rich, nutritious forage which keeps the stock growing constantly throughout the year. To accomplish this they have adopted a regular system of soiling, known as folding or hurdling.

As a general thing, the English feed less grain than we do. Again, it is very important to the wool grower that his flock should have an abundance of food throughout the entire year. Whenever the pastures fail, the growth of wool is checked, and if the sheep be afterward well fed, there will be found at shearing time a weak place in the wool, corresponding to the time in its growth when the food was insufficient. Wool, like milk from our cows, is produced in proportion to the amount of food consumed above that required to support life. Therefore, the want of a proper amount of food is first noticed in the wool, and here is where many farmers are deceived. Their sheep look to be in passable condition, and they are satisfied; but the sheep are not growing a profitable amount of wool, as they would if supplied with all they could eat. Says Mr. Miles, "The great development in fattening quality and early maturity has been secured by a liberal supply of nutritious food during the period of growth."

Mr. Youatt, an English author, says: "It is of the utmost importance that the ewes should have abundant food, in order to produce a flow of nutritious milk while they are suckling, and that the lambs should have plenty of good pasture or other succulent green food when they are weaned."

Speaking of the Lincoln breed of sheep, Mr. Stewart says, "In connection with a system of farming in which heavy crops of roots and green fodder were the chief production, this improved breed became fixed in its character as the heaviest producers of wool and mutton in the world."

During the early part of the season, when vegetation is putting forth vigorously, sheep do very well in pasture, but, by the time they have overcome the effects of winter, the pasture begins to fail. The ewe must eat to sustain herself and support a lamb, often two; at the same time she is also expected to be growing wool for the farmer. If she is not well provided with the best of food to produce milk, wool and flesh, the wool is first affected, then her offspring comes late to maturity, sometimes never; then her own body becomes a ready prey to parasites and disease, and she goes into winter quarters poor. A few years of such life hang her hide upon the fence, and give her carcass to the crows.

There are many farmers keeping sheep who have no interest in their improvement, for the reason that every two or three years the rotation of the fields shortens the supply of pasture, and the flock goes to the butcher. They pick up a few culls after a year,

and begin another flock, which in turn follows the course of the first. The farmer has no objection to selecting a good sire as a means of improving, because he doesn't know but what he will have to dispose of his flock another year, if he should be likely to lose a seeding, or be short of pasture.

There is probably no source of easier profit on the farm than a flock of well-cared-for sheep. Manure made from them is richer in nitrogen and potash than from any other animal, not excepting the hog and the hen. Their wool and lambs are in the market just when the farmer has the least to sell; they require little care compared with cows and horses, and increase more rapidly. In fact, to deprive a farm of a flock of good sheep is to rob it of one of its most pleasing and profitable attractions. There is a way in which they may be supplied with food, rich and succulent, when they most require it; a way in which the lambs may be made to grow continually from birth, and be early brought to full maturity; a way in which the farmer can produce the greatest amount of wool superior in quality, manure unequalled in value, and make himself the possessor of a beautiful flock of sheep, and that is by soiling.

I never regretted parting with any farm animals as I did with my flock of sheep. Nothing I ever grew afforded me the pleasure or profit, nothing I ever undertook to improve by careful breeding and feeding responded so quickly and well. My success as an exhibitor with both horses and cattle is owing principally to soiling. It is a question if ever a

flock was more improved in the same length of time. In 1875 I made my first exhibit outside of country fairs, at the New York State Fair, at Rochester, N. Y., and came home with a second prize on a ram lamb. Three years later the flock came home with the Sweepstakes Flock medal, won in competition with the three best flocks of Cotswolds in this country. Afterward during five or six years they never failed to bring home the largest share of the prize cards.

The Cotswold, like all families of large-bodied, long and medium wooled sheep were originated in England, where the climate is cooler, and where they are soiled on vetches and rape summers, and turnips during autumn and winter, until rape and vetches come again. So that they have come up with habits of idleness in comparison with our American merino and ordinary grades, which are content to grub all day on scanty pastures. By soiling, the English breeders have been able to supply their sheep daily, from birth to maturity, with more forage than they could possibly devour. Americans fail to get the same results from English-bred sheep, simply because they are not as good feeders. When we get them to the States, we turn them to pasture, and they get on fairly well until June, when they prefer to lie in the shade than to seeking their food in the hot sun. Cotswolds, Lincolns, and Leicesters, and the Downs as well, excepting possibly the Southdown, will not work all day as they must at pasture, to produce the best results.

Therefore, to make them do their best in this country, or to equal English-grown sheep that are kept feeding all the time, some way must be provided to accomplish the same end. We must remember that feed is mightier than breed. In fact, feed has been the making of breeds. Feed is, at least, the foundation of all modern breeds. Select animals from the choicest prize-winning flocks, the best in England or America, and neglect to feed them, and they soon degenerate into an ordinary race from whence they originally came. Selecting and coupling help to fix type, but food makes the breed. When a sheep breeder in America will make his sheep eat as much as an English shepherd, then he can grow in America as good specimens as they grow in England.

After meeting my Waterloo in the show ring at the State fair, as already referred to, and not being sufficiently forehanded to buy a lot of imported sheep, as was the yearly custom of my principal competitors, I was either obliged to give up showing or take a back seat or reach for the prize in some other way. It so happened that my sheep were pastured the next year in a field adjoining the barn, and they were allowed the freedom of their winter quarters, where they were obliged to come and drink, and, as may be imagined, during the hot weather they spent the greater part of the day in this shed or under the shade of a board fence. In bringing in the soiling crops for the cows, the wagon passed the sheep shed, and as there was never in my estimation anything too good for my Cotswold ewes

(even if they were not good enough to win at the New York State Fair) there were always a few forkfuls thrown into their winter racks in passing. The sheep were delighted. The lambs grew as I never had lambs grow before. It was not uncommon to have them weigh 100 lb. at three months old, a gain of a pound a day for every day they were old. Of course, they had a lamb creep, as shown on page 183, where they could run into a separate pen and help themselves to bran with a little oil-cake meal in it. Later in the season a little cracked corn was added. I never had my ewes look as well or give as much milk; and when we came to shear them and their lambs the next season, the increase was twenty-five to thirty-five per cent. Thus I unintentionally worked into the soiling of my sheep. The second year soiling was begun earlier and continued later. My sales of rams increased beyond all expectation, and the third year a rough board shed was built with a rough board roof, and soiling crops were put in especially for the sheep, as hereafter explained; and that fall, as before stated, the flock won the Gold Medal Flock prize with American-bred ewes and lambs against the best flocks in the State, which this would never have been accomplished except for soiling. When in England in 1890 for the first time, I saw how sheep were universally soiled, and how it was that Americans have been obliged to keep going there for show sheep. It was also apparent how it had been possible for English breeders to produce such grand specimens as are found in the several

long and medium wooled families of that celebrated sheep country. These sheep were by education unadapted to our general method of pasturing. They are too large and too much affected by the sun to work as most American pastured sheep are obliged to, and as only an American merino is willing to do over scanty pasture. There is, I believe, but one way to treat the English families of sheep to make them equal to English-bred and English-fed sheep, and that is to soil them.

Results.

From 1877 to 1883 my Cotswold flock won over $1,000 in premiums, besides several gold medals, flock prizes.

The following table of comparison of the amount of wool taken from the same sheep following a year at pasture and after two years of soiling shows the effect of their having an abundance of food during the entire year, so that there was no check in the growth of wool:

1878, thirty head of sheep pastured year before.....	280 pounds.
1879, twenty-eight head of sheep partially soiled year before.....	330 "
1880, thirty-seven head of sheep principally soiled year before.....	550 "

Those clipped in 1880 were wintered mostly on silage and bean fodder. In every other respect they were cared for as in the previous years. It

will be noticed that the last clipping for 1885 averaged nearly fifteen pounds per head for the entire flock; the shearling ewes averaged over sixteen pounds.

My lambs, during the years 1880 and 1881, were weaned July 1st, and at the average age of four months, the average weight was a trifle over ninety-one pounds, many of the single lambs weighing a pound or nearly so for every day they were old. As many of them were twins, the average was reduced. The above results I have never known to be equalled by any flock of Cotswolds, or any other breeds of sheep in America. The secret of my success was keeping the sheep eating, and giving them a shady place to eat in. The extra labor was returned several times over. I give soiling the credit for these results.

CHAPTER XV.

SOILING CROPS FOR SHEEP.

In selecting crops for sheep, the most prominent are tares (vetches), rape, turnips, lucern and clover (early cut), oats and peas. Of these, rape and vetches are decidedly the best.

Vetches (Tares).

Spring and winter tares are largely sown in England for soiling sheep, cattle, and horses. All stock are exceedingly fond of them. My experience in feeding them is very satisfactory. I have never undertaken to cultivate the winter variety. Spring tares are usually sown in March or April. They are very much like the common field pea, except that the stalks and leaves are finer, a vigorously growing plant, highly relished by sheep and lambs. The blossom and pod are similar to those of the pea. A small quantity of oats, barley, or rye should be sown with them as a support, otherwise they are apt to lodge, which materially lessens their value. They may be sown with a grain drill or broadcast.

An English writer says: "Sheep may be fattened upon them, the milk of cows is enriched and in-

creased by them, and they are extensively employed in feeding horses. They do not require a rich soil."

Sow same as field peas, two bushels per acre in a grain drill with one bushel of oats.

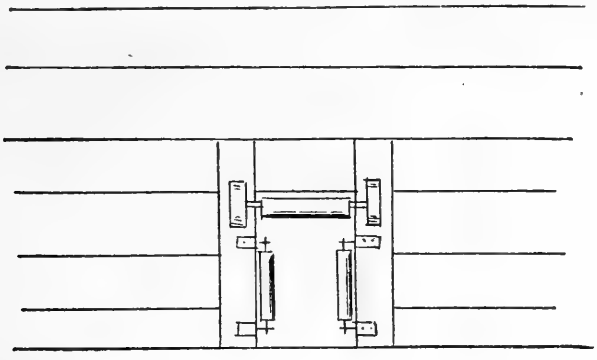
Rape.

Rape may be called a turnip which has all grown to leaves. It looks and tastes like turnip tops, but has roots similar to those of grain and grasses. The seeds also look like those of the turnip. It grows from ten to fifteen inches high. It is a most nutritious forage plant, and is equalled by no other vegetable, as may be seen by the foregoing tables. Its culture is similar to that of the turnip, and will sustain about the same number of animals per acre, and may be sown later in the season. As a food for young lambs it has no superior. It was my custom to sow a small patch in the corner of the pasture or in an adjoining field to the place where the ewes are confined, with a lamb creep—a hole in the fence large enough to admit a lamb but to exclude a sheep, with a roller at the top and sides to prevent tearing the wool, as shown in the following illustration.

The lambs will soon learn to run in and feed, as they are exceedingly fond of the plant. It requires about two pecks of the seed per acre, which should be sown in July for fall feeding. If intended to be fed to grown sheep, it should be cut and fed to them

in racks: otherwise they destroy much of it. Lambs may be allowed to pasture upon it, as they are light in weight, and, if unaccompanied by their dams, only stay in the enclosure while feeding. The high feeding value of this plant strongly recommends it to farmers raising early market lambs. For this purpose it should be sown earlier.

I began growing rape at the suggestion of Mr.



Lamb Creep.

John Ross, of Jarvis, Ont., a noted Cotswold breeder in his day, with the result that I never have found any forage so satisfactory for forcing lambs, or so good for age ewes and fattening store sheep, or in putting the finishing touches to the animals selected to lift the prize cards at the autumn fairs.

I usually obtained the seed from Canada, where rape is used more extensively than in the States. The chances for getting good, fresh seed there are better, therefore, than in the States.

The principal requirement is to have a thoroughly pulverized seed-bed, and to sow in drills with a hand seeder twenty inches apart, and cultivated two or three times with a horse hoe between rows; and if ground is weedy, use a garden hand-wheel hoe once or twice on the rows.

For a general fall crop, sow broadcast just after the last cultivating among the ensilage corn, the same as you would flat turnips, and by the time that the summer feeding is over, you will have a grand crop for September and October, either to soil from or to turn the sheep on.

Rape is the best possible green forage to have on hand at time of weaning the lambs, so that they will not go backwards. Lambs may be taken from the ewes earlier, if rape is at hand, than without it, giving the ewes more time to recuperate, therefore, coming sooner and in better condition to the coupling season. There is nothing like a field of rape to put ewes in the finest possible condition for going into winter quarters, and if grown on the ensilage ground without cultivating, is most economical, and will do what would require a very liberal grain feeding to equal.

As rape is a crop not generally known in the States, the following quotations are given, which confirm all I have said in its favor and more:

United States Bulletin, 11.

"There is still a season after the corn has been harvested and before the setting in of winter, dur-

ing which we must depend solely upon grass as a source of food for our flocks and herds, otherwise we must draw on our winter stores to feed them.

"The Dwarf Essex rape is a plant which can be

Rape Plant, showing growth of two months on station farm, July to August, 1894.

easily grown in many portions of the United States, and which will furnish abundant supplies of succu-

lent, rich and nutritious pasture at a season of the year when most needed. The rape plant grows slowly at first, but after a time pushes ahead rapidly. Where the conditions are suitable, an average crop grown in drills should furnish not less than ten tons per acre, and when the conditions are all favorable, it should be quite possible to produce at least twenty tons of green fodder per acre. A large percentage of Canadian lambs shipped during the more recent years to Buffalo market from Canada have been finished on rape. Larger crops can be obtained from rape sown in drills rather than broadcast.

"Salt is a valuable fertilizer for rape on certain soils. In some seasons a good crop of rape can be grown after a crop of winter wheat has been removed. We found that one acre of rape would pasture thirty-six to thirty-seven head of lambs for two months. It would probably be correct to say that rape will grow in fine form in any soil that will produce an abundant crop of turnips or Indian corn. Rape calls for fine pulverization of surface soil free from undecayed vegetable matter. Rape responds vigorously to the application of barnyard manure. Rape is a gross feeding plant; therefore, has much power to gather plant food in the soil.

"Rape is unrivalled as a pasture for sheep in autumn. As a fattening food in the field, it is without a rival in point of cheapness or effectiveness. It does not detract from the fertility when the sheep which eat it off are inclosed upon it."

Turnips.

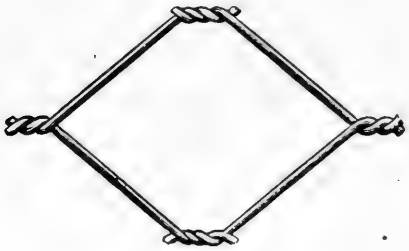
The turnip in England has become a regular rotation crop, and takes the place of corn in this country, *i.e.*, first turnips, second barley, third wheat, fourth grass or pasture. The varieties mostly used for feeding stock are the White Norfolk, Yellow Aberdeen, Swedish, and Dale's Hybrid, "which latter is a hardy, succulent vegetable, much relished by stock, and in no respect injured by the severest winter." It is sometimes sown broadcast, but is found to pay better when sown in drills and cultivated. Turnips may be sown from the last of May till the second week in July.

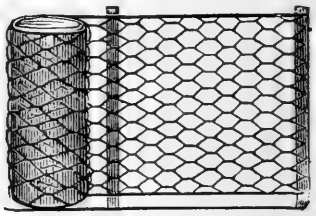
These are the principal soiling crops for sheep, in connection with the other forage crops which have been considered under the general head of soiling crops, especially oats and peas, lucern, vetches or tares.

CHAPTER XVI.

PORTABLE FENCING.

THE woven galvanized wire fencing, supported by stakes driven into the ground every ten feet, makes one of the most convenient and easily handled of all

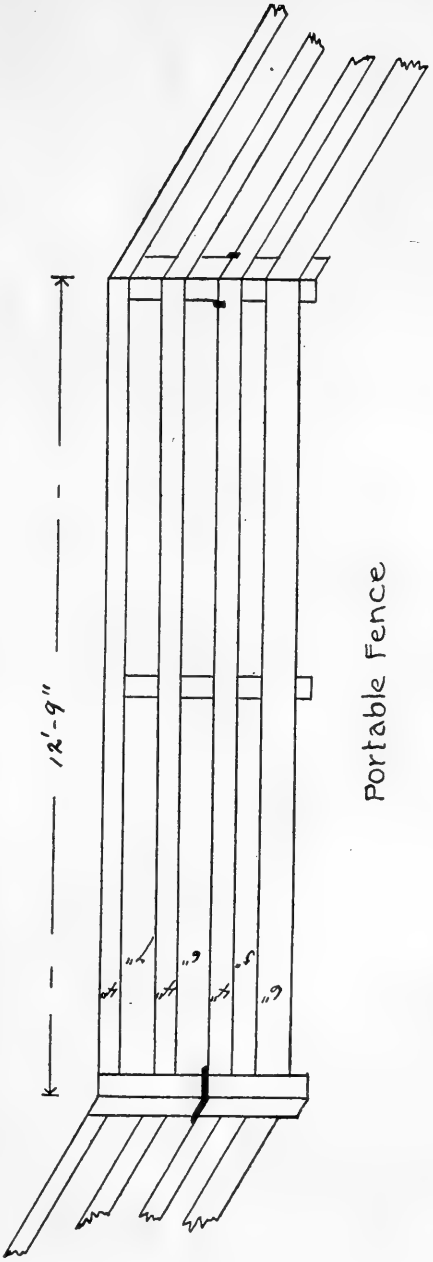




portable fencing for sheep. Three or three and one-half feet will be found high enough. One man can handle a roll of 300 feet. (See cut.)

If it is desirable to have a portable fence, the following can be recommended: The battens at the ends are nailed on opposite sides of each panel. The panels are held or locked together by a 3/8-inch steel or iron rod, bent as shown. To erect the fence, one panel is set up end to end of another, the steel rod is hooked onto the second board from the top of each panel. Thepanel last set up is then swung to the left or right, as the case may be, until the iron rod brings the two ends tight together. The next panel is put up

with the rod on the opposite side of the panel, and is swung in the opposite direction. This makes a slightly zigzag fence, just enough so that each panel braces the other. Every tenth panel has six 6-inch blocks bolted on to it, two at each end and two in the middle. These blocks are to answer the purpose of runners to move the fence. The panel with the block on is first laid upon the ground; on that the other nine panels are laid. A horse is hitched to the bottom one, and the ten panels are sledded along, and set up wherever wanted. There is now on my farm a hundred such panels that were made in 1885. The hurdles are made twelve feet long, the three upper boards, 1 × 4 inches,



are from sixteen-foot boards. The six feet sawed from them makes the two battens. The bottom board is six inches wide, and bought in twelve-foot lengths. The end battens are allowed to project three inches below the bottom board, so that the bottom boards do not rest on the ground; the panels, therefore, adapt themselves better to an uneven surface.

Feeding Racks.

A movable feeding rack is a most convenient thing, when it is desirable to feed soiling crops over the fence. It is equally serviceable as a winter rack. The roof projects over the sheep, affording some shade. This is a very essential addition to such a rack for summer feeding. The roof is made of clapboards or novelty siding. There is a ring for a clevis in either end, to which a horse may be attached, to draw it from place to place, or to move it along the fence as the cutting of the soiling crop on the opposite side requires, so that a forkful may be delivered into the rack from over the fence. These racks are ten feet long, and cost about $10 to make with turned slats.

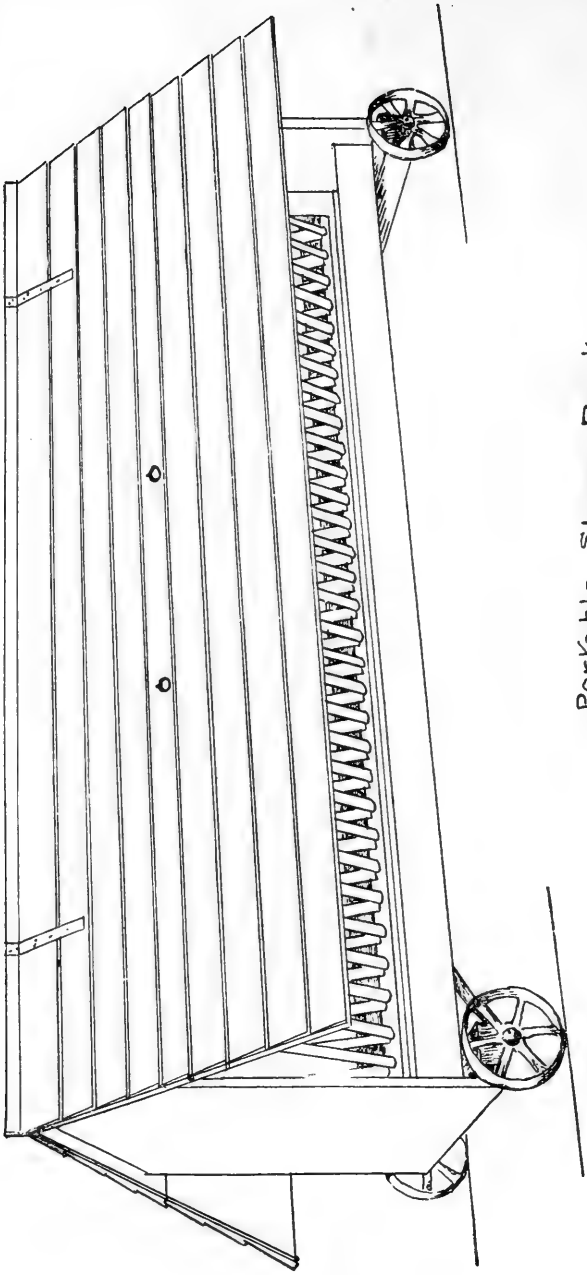
CHAPTER XVII.

MANNER OF SOILING SHEEP.

Laying Out the Work.

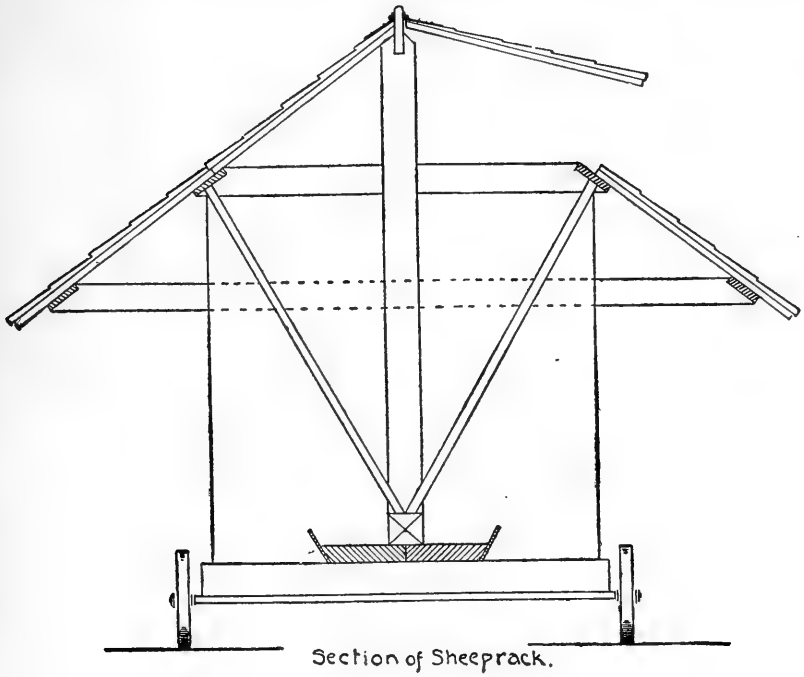
We will consider briefly the methods adopted for feeding sheep by the soiling system. If moved about from field to field by the rotation of crops, they may be supplied with any of the soiling crops just mentioned, by fencing off a portion of the field in which they are pastured, and devoting that portion to the growth of soiling crops; or a small portion of an adjoining field may be used for that purpose. In either case the several crops should be sown or planted in rows parallel with the division fence, the crop for the first feeding being nearest the fence. A movable rack (see cut) in the pasture will serve to hold the feed as it is cut.

Each seeding is intended to supply food for one month, beginning about the 1st of July on the first sowing, cutting with scythe or cradle, and throwing the cutting over the fence into the rack. By the time the first sowing is consumed, the second should be ready for cutting, which may be done in a direction opposite to that of the first cutting, following back with the rack. The first crop next to the dividing fence may be oats and peas (one bushel



Portable Sheep Rack.

of oats, two of peas or vetches), the second, third, and fourth, rape. After the first and second sowings have been cut, the ground which was occupied



by them may be top-dressed and cultivated in, or plowed shallow, and sown to rape for late fall feeding.

In estimating the amount of ground necessary to supply a flock with forage, we apply the same rule as given for calculating the amount required to sup-

ply 1,000 lb. (or a full-grown cow). Thus, sheep averaging 100 lb. would require each one-tenth of that necessary for a cow, or, of oats and peas, one-tenth of three-fourths square rod per day. This estimate for sheep in the plan of feeding above described may be reduced to at least half a square rod per day for every 1,000 lb., as the sheep will obtain part of their feed from the pasture; but this part will, of course, depend upon the size of the pasture and the fertility of the soil. My own experience in soiling in this manner was in an old orchard containing five acres, one acre of which was fenced off as above described. This four acres of pasture and one devoted to soiling crops kept twenty-four head of large, long-wooled sheep, and twenty-two lambs (fully equal to five head of 1,000 lb. each) during the season. This leads to me to say that, as a rule, for every 1,000 lb. it will require one acre of land, one-fifth of which should be devoted to soiling crops. It is safe to say that the five acres, with one devoted to soiling crops, were equal to ten pastured, or that one acre soiled is equal to five pastured. The variety of the feed and the shade made the sheep contented, and, better still, they had all they could or would eat.

Permanent Pasture.

Another method of feeding is practised to some extent in this country, *i.e.*, soiling the sheep in connection with a permanent pasture. One acre of

permanent sheep pasture is generally speaking, worth two or three acres of new seeding.

The plan is to have a field properly located and laid down to a large variety of grasses, some early, some medium, and some late in coming to maturity, some that grow thickly making a compact sward, others that send down long tap roots to enable them to withstand drought. The following varieties are none too many and make a most valuable succession, and if once well established become a source of much greater profit than the ordinary seedings that follow a rotation of crops.

The following-named varieties and date of maturity make a splendid combination. The amount in pounds are the proportion of seed for one acre:

Varieties of Grass.	When Flowering.	Pounds Per Acre.
Sweet scented vernal	April and May	4
Orchard grass	April and May	6
Sheep's fescue	May and June	3
Kentucky blue grass	May and June	4
Indian rye grass	June	4
Red top	June and July	4
Timothy	June and July	4
English rye grass	July and August	6
White clover	May to September	5
Total number of pounds per acre		40

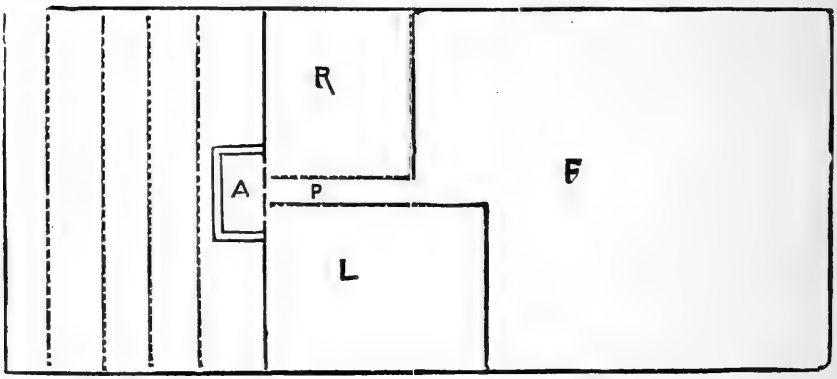
The seeds for an acre will cost $7 to $10, but when a pasture of this kind is once established, the difference in the first cost is normally nothing. There should be a very thorough preparation of the soil,

even if it takes three years, as it did in my experience, to get the field in suitable condition. The land should be as rich and free from weeds as possible, using either green manure or thoroughly rotted barnyard manure to reduce the introduction of foul seeds to the least possible amount.

Feeding.

With such a permanent pasture the method of growing soiling crops for sheep may be illustrated as follows:

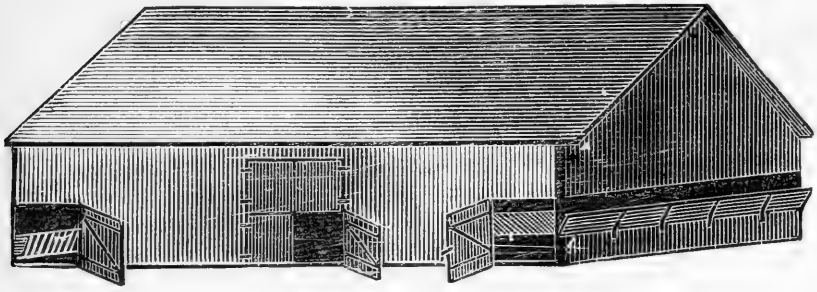
F, L, R, comprise the permanent pasture or the feeding shed. L and R show how rams and ewe



lambs may be separated from the floor by portable fencing, under the enclosure, so that they may also be fed on green forage in a portion of the shed.

The following illustrates the feeding shed, which, in my case, was made of rough boards and the roof was of rough pine.

This shed stands on ground devoted to soiling crops fencing the permanent pasture, so that the shepherd or soiler may drive on the three sides of the



building, putting the feed through into racks from the wagon, as shown, without disturbing or going among the sheep. There are no gates to open.

A patch of rape may be sown and fenced off in the field devoted to soiling crops for the lambs, giving them access to it by means of a lamb creep, as already shown, page 183, or in any other fields adjoining the permanent pasture that may happen to be under cultivation.

A portion of the shed may also be partitioned off for the lambs, where they can help themselves to bran and crushed oats and oil cake at will. They will not injure themselves by over-eating if they run that way. They also enter this enclosure by the lamb creep.

This method was adopted at Maple Lane with great success. This system replaced the movable rack already referred to. I liked it better because the sheep liked it better; it afforded better shade.

The sheep remained in this enclosure the greater part of the day, and, of course, ate a great deal more than in a field where, in warm weather, no matter how tempting the pasture, they spent most of their time lying under the fence.

Of course the sheep must be supplied with water and salt. The idea that sheep do not require water is only an excuse for not supplying it. A sheep never cares to drink much at a time, but likes a sip quite often. I have always found it more profitable to indulge the wants of my stock than my own.

The feeding racks are filled three times a day, morning, noon, and night, and this may be done by a boy. No more should be fed at a time than the sheep will eat, and, should there be any left in the racks, it should be removed before fresh feed is added. The shepherd will soon learn the wants of his flock. Another method of feeding is that of folding the sheep upon the soiling crops instead of cutting them. Formerly (in England) this was the practice, but lately they have more generally adopted the practice of cutting and feeding in racks.

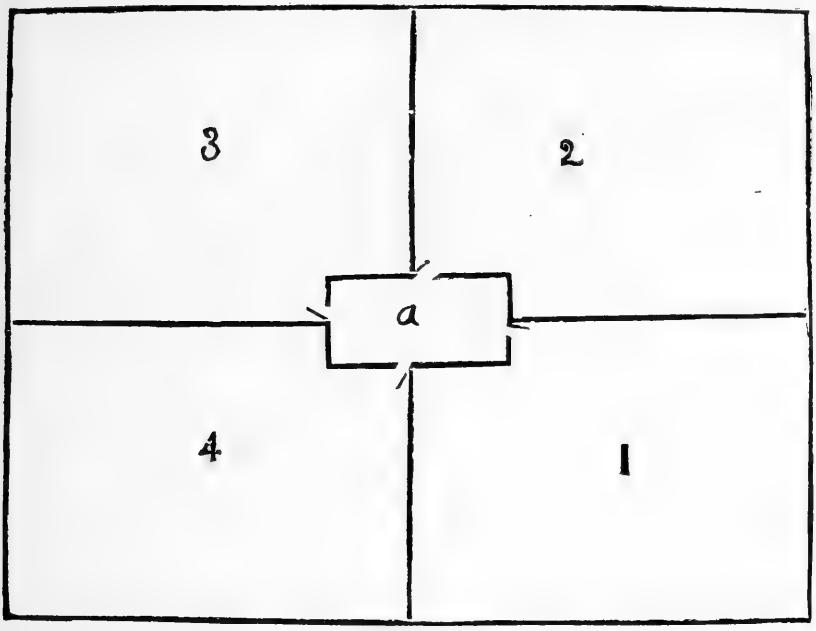
Rotation of Crops.

When a rotation of crops is considered profitable, the following arrangement might be suggested:

a, Represents the feeding shed; 1, 2, 3, 4, four fields of enclosure in one field.

Starting with fields No. 1 and 2 as pasture lots, No. 3 is devoted to soiling crops, and No. 4 to

roots or rape, No. 3 being seeded to grass with rye in the fall. The next season plow No. 1 for rape, having been plowed shallow the fall before. No. 4



is now devoted to soiling crops and No. 2 and 3 to pasture, and so on in succession around the house. This plan would possibly require more land than the other, but it might be found to work to even better advantage.

CHAPTER XVIII.

SOILING HORSES.

Brood Mares and Colts.

After leaving the Maple Lane farm in 1883, and where the operations in soiling and ensilage began, and were recorded in the first volume of this work, published in the winter of 1880 and 1881, we moved to Livingston County, N. Y., where on the "Murray Hill" Farm the soiling system summer and winter was practised, with thirty-six head of Jersey cattle and forty-two head of Cotswold sheep. To this stock fourteen brood mares and twelve colts were put on a strict soiling system, while the five stallions in the stud came in for no small share. Two two-year-olds were fed on soiling crops almost entirely, while the three stallions in the stud were put on soiling crops after the spring breeding season was over, so that with cattle, horses, brood mares, and colts, and sheep, to say nothing of the swine, we were soiling all told at least sixty head of full-grown stock, not counting in the stallions.

The forage for these sixty head, counting pasture, hay, silage, and soiling crops, was sixty-nine acres of land the first year. We remained on the "Murray Hill" Farm only three years, when the cattle and

sheep were sold, and the horse business was carried on alone on "Squawkie Hill," where, at one time, we had between thirty and forty head of brood mares and colts that were always supplied, more or less, with soiling crops during the summer. For brood mares with foal at foot, oats and peas make a grand feed. There is nothing, however, that seems better suited to horses than lucern, where land is adapted to its growth.

The horses, like the cows, were always fed soiling crops in their stall daytimes, and turned out nights; and any one who wishes to raise a thrifty colt, and keep the mother in reasonably good condition, can be assured that soiling is the best and most economical way to accomplish that end. My success in the show ring with horses as well as cattle was owing largely to soiling. The following is a clipping from the "Live Stock Journal":

"This class of stock (horses) is thought by many to be unadapted to the soiling system, especially colts, as they require exercise to develop the muscular power, and soiling is thought to require too close confinement. This arises from misconception of the flexibility of the system. Soiling does not necessarily require the confinement of animals any more than pasturing. It is true that pasturing furnishes larger fields to range in, but nearly every farmer can devote a lane running to the wood-lot as space to exercise in. This lane is necessary for the convenience of the farm, and generally furnishes a road to the different parts of the tillable land and

meadow. This will furnish the colts abundant room to make trials of speed, and afford all the exercise necessary to develop muscle. This run-way is easily fenced so substantially as to prevent the colts from jumping, and thus becoming troublesome. I have raised a dozen colts in this way, and found them to develop in every respect as well as those pastured. We found this plan to work with brood mares and their foals. Having the food of the mares wholly under control, their production of milk will be more uniform, and the growth of their foals much better, than on pasture. The dam requires full feeding upon appropriate food, and this may always be given in soiling, as any defect in the succulence or nutrition of grasses or other soiling foods may be supplemented with middlings, oil meal and oats. The foals are also constantly under the eye of the feeder, easily become accustomed to handling, and may be taught to take other food at a younger age. Early familiarity with the attendant and docility are not only favorable to the foal's progress in development, but to its easy management at the training age. The vigorous, steady, and healthy growth of colts is most essential to their future value as serviceable animals, and, therefore, to the profit of the breeder. Soiling offers the most complete control over the food and management of colts; and therefore, under this system, they may be grown with much more uniform success, and, on land worthy $50 or more per acre, much cheaper than by pasturing. The foal responds more quickly

to the use of cow's milk than any other food after weaning, and this may be skimmed milk, after teaching it first to drink new milk. The colt being under attention in soiling, this extra food may be given with little extra labor. From considerable experience I consider the soiling system as well adapted to the raising of horses in all stages, from the suckling colt to the mature horse."

CHAPTER XIX.

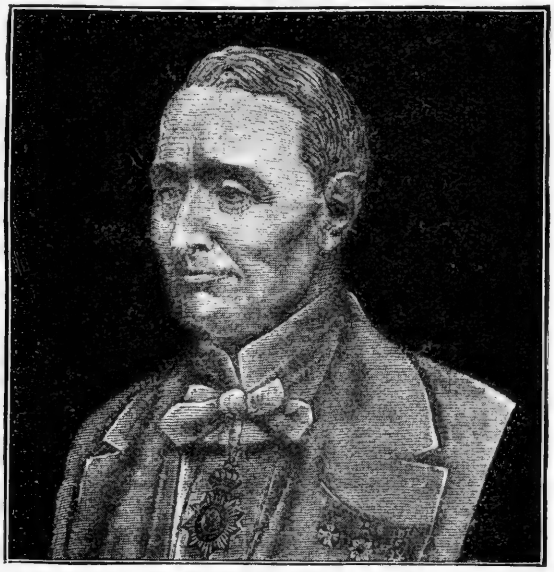
WINTER SOILING (ENSILAGE).

History.

In 1875 there first came to this country reports of experiments made in France, by Monsieur Auguste Goffart, of preserving green forage. After many trials and failures, and the expenditure of considerable money, his labors were crowned with success. The same year the French Government awarded to Mr. Goffart the Cross of the Legion of Honor.

M. Goffart first successfully ensilaged cut maize in 1873. For years he held to the idea that the green forage should be partially cured, and that it should be put in the pit in alternate layers with straw, until, more by chance than otherwise, he discovered that the curing process and the use of straw was, more than anything else, defeating the end in view. Although ancient historians mention preserving grain, and also forage, in pits dug in the ground, the system had been discarded for hundreds of years, and M. Goffart deserves all the credit for its rediscovery. He must have been a most persistent and resolute man, for year after year he was obliged to cart out the forage he attempted to preserve, as so much manure.

After adopting a strict soiling system with my cattle, as already explained, it was found that more stock could be supported on the farm during the summer than could be carried through the winter, which was contrary to the general practice under



AUGUSTE GOFFART,
Born at Le Quesnoy, France, April 6, 1811. Ensilaged Cut Maize, Burtin, 1873.

the pasture system. This naturally attracted to the reports of M. Goffart's success in the saving green forage, for it was apparent that if ensilage was a success it would enable me to soil my cattle winters as well as summers.

Francis Morris, of Ellicott City, Md., experimented with whole corn in a trench or pit dug in the ground and covered with earth; he reported

that he found the corn fairly well preserved, and that his stock ate it well. To Dr. Bailey, of Boston, Mass., belongs, however, the credit of building the first silo in America, a successful opening of which was reported in "The Country Gentleman" in December, 1879. I hastened to Boston to see for myself. The doctor went with me to his farm at Billerica, Mass., and I saw the cows eating the silage; and when hay was put into the racks on top of the silage, they pushed it aside, preferring the silage. I had to admit "that there was no accounting for taste," but also "that the proof of the pudding was in the eating." The cows seemed to relish it, and have a hearty appetite for it. This settled the question for me. The following season we converted an old cobblestone carriage-house and horse-barn into a silo by taking out the hay-loft floor, walling up the doors, and windows, and giving the interior a coat of waterlime cement. This building was twenty or thirty rods from the cattle barns, and all the silage had to be carted there, but no matter. If my cows could be soiled winters, I was willing to put up with almost anything to accomplish it.

This stone barn made a silo eighteen by twenty-four inside and twenty feet deep, which was filled the following autumn and heavily weighted with stones (which were thought necessary at that time). This silo answered the purpose, and was a success from the first.

I believe this was the first silo in the State of New York, and the second in the United States, not count-

ing Mr. Morris's experimental earth silo. I speak of this with some degree of pride, because I was at that time subjected to much ridicule. Soiling my cattle summers was bad enough in the estimation of my neighbors, but ensilage (sauerkraut as it was then called by many) was the capsheaf of folly.

However, the cattle liked it, and I liked the cattle. The sheep ate it, and nothing that I could do was too good for them. The neighbors laughed at me. The cattle and sheep also laughed at me whenever they saw me coming on a load of sauerkraut. I was getting 50 cents a pound for butter, and I also had to laugh.

As to the result it fully met my expectations, but I have never claimed, as some have, that it takes the place of soiling, as will be shown under a heading entitled Soiling vs. Ensilage.

The only thing that can be said of ensilage now, compared with ensilage in 1879 and 1880, is that the method of handling the crops is much simplified, and the construction of wooden silos instead of masonry, as was then believed necessary, has greatly reduced the expense of construction. The perfection of a corn cutter has lessened the labor and expense of harvesting the corn, until the system has become quite generally adopted, and is now within the reach of almost any farmer.

Ensilage vs. Cured Fodder.

The same grasses on which a cow feeds and thrives in summer, and which enabled her to produce an abundant flow of rich milk, and butter superior in color, and flavor, and quality, when cured and fed to her in the winter (or summer either for that matter) produce far less in quality and quantity, and the butter is also inferior in color and flavor.

Young cattle thrive during the summer, while during the winter, if they hold their own or a little better, they have done as well as most farmers could expect even when a little grain has been added.

If it were possible, therefore, to supply our stock in winter with such succulent and nutritious food as they are able to obtain on grass, the difficulties above referred to would, in a great measure be overcome. Ensilage comes the nearest to supplying these conditions of anything we know of for a winter forage. Our experimental station, by careful and repeated analysis of cured-corn fodder and ensilage, sometimes find a result in favor of one, sometimes the other, but generally it has been in favor of ensilage.

First, the chemist puts both ensilage and cured-corn fodder in a dry kiln to note the amount of moisure (all juices of plants being recorded as so much water). The kiln-dried product is then subjected to chemical tests, and finally consumed,

burned. As a result they find the feeding and manurial value of both samples.

Although all juice of the plant is looked upon as so much water, curing clover hay or cornstalks, and then adding to them as much water as they lost in juice, this, while it usually gives better results than when fed dry, does by no means restore the forage its full feeding value. You may go a step farther and cook or steam the feed, and still you have not been able to bring back to it what it possessed, or, at least, what the animals are able to extract from the same food in its green, succulent state.

That ensilage contains greater feeding value than cured corn, no one should expect. There is certainly nothing within the four walls of a silo to manufacture albuminoids, carbohydrates, or fat; therefore, whatever difference there may be in the result of feeding green forage and cured, that difference should be credited to the juice of the plant as so much food. Every farmer knows that whole cornstalks are always fed at a waste. From fifty to seventy-five per cent. of the stalk goes into the manure pile, unless absolute hunger induces the stock to eat more than they otherwise would. Even when run through the cutter a large proportion is wasted. The experiment station says that the grain is forty-five per cent. of the plant, and that forty-five per cent. of the value of the plant is in the stalk below the ear, and only ten per cent. of the value of the stalk above the ear.

Palatability.

Then comes the question of palatability. A piece of fat pork may furnish more nutriment to a person than a whole loaf of bread; but if the person dislikes the one and enjoys the other, what comfort or benefit is that person to get from a chemical analysis? When a cow leaves hay to eat ensilage, and hungers for it, what good is it to the cow, or to the owner either, to know that the hay contains the greater feeding value? This is another point that is invariably lost sight of at experimental stations. If a cow eats cured stalks simply to satisfy hunger, and has a relish for ensilage in quantities controlled only by her capacity, it is not a question of albuminoids, carbohydrates, and fats, but of dollars and cents to the owner. "Allowing the cows to eat as much as they wanted of corn silage and fodder corn with the same ration of hay, bran, and oats, they were able to give more milk daily, which contained more fat on the ensilage than on the fodder corn, while the quantity of butter produced on the ensilage feed was more than on the fodder-corn feed." At the same time the cows invariably consumed less dry matter when on fodder than when on ensilage.

Ensilage vs. Hay.

The advantages of winter soiling over the feeding of cured hay and cornstalks may be summed up under the following heads, but as these points have

been discussed largely under similar headings and under summer soiling, a brief mention of them will suffice.

First. The increased acreage of the farm. Here in adopting winter soiling lies the great and unmistakable value or profit, and it is passing strange how for years and years the question hung on the point of what analysis was able to prove compared with hay or dried corn fodder. The question is the same as with summer soiling. What is the use of discussing whether there is more feeding value in a ton of grass or a ton of oats and peas? What the soiler wants to know is how many more head of cattle he can support from an acre.

It may take two or even three tons of ensilage to equal a ton of hay, but if by growing ensilage the farmer can make one acre produce an equivalent in feeding value to five, six, and even seven tons of hay per acre, there is a gain so distinct that he who runs may read. It matters little whether science agrees with the cattle or not. There are hundreds of thousands of farmers who have demonstrated that ensilage is a good thing. They have doubled the number of their dairy, they are getting twice as much milk a year as formerly, making twice as much manure, and growing crops that have in many cases doubled the former yield, and they have done it all without buying more land.

The following table shows at a glance the real value and advantage of ensilage over hay. It may be stated that, as a rule, land that will produce one

ton of hay per acre will produce fifteen tons of ensilage, and land that will produce two tons of hay per acre will produce thirty tons of ensilage per acre. Two tons of ensilage is fully equal to a ton of hay in feeding results, no matter what the chemist says as to their comparative analyses.

ENSILAGE VS. HAY.

	ENSILAGE.		HAY.	
	Dr.	Cr.	Dr.	Cr.
Value one ton of hay at $12 per ton	....	....	....	$12.00
Seed per acre	....	....	$1.00	
Cost of cutting and delivering to barn	....	....	2.50	
Value fifteen tons ensilage (two tons ensilage equal to one ton of hay) $6 per ton		$90.00		
Seed, fitting the ground and cultivating	$5.00			
Labor to cut and secure fifteen tons, estimated.	11.00			
Net feeding value	....	$74.00	....	$8.50

The use of the land is the same in both cases. I have not taken the question of manure into account. My experiences in plowing portions of meadows for ensilage, at Maple Lane, were as follows: Five and one-half acres of an eight-acre field of hay was planted to ensilage without manure. We cut nearly thirty tons of ensilage per acre, as proved by the number of cubic feet of ensilage in the silo, when settled, estimating fifty pounds per cubic foot. I am positive that from the remainder of the field there was not cut more than a ton and a half of cured hay per acre.

On Murray Hill the experiment was repeated on land that only produced three-fourths of a ton of clover per acre. From the same field we cut at least fifteen tons of ensilage per acre without manuring the piece.

Several times in this work attention has been called to the saving of land by the soiling system, as its most distinctive feature, as shown by the table. The feeding value of an acre of ensilage or an acre of grass is ten to one. It is passing strange that experimental stations, and the public in general, have been so slow in comprehending this point.

Cured Corn vs. Ensilage.

There is only one answer to the question of cost between curing corn stalks and ensilaging the same, allowing there is no difference in feeding value, and the answer is in favor of silage. It always has been, especially if the cured fodder is run through the cutting box or shredder; in both cases the planting and cutting are the same. Both have to be delivered to the barn. In this there is something saved in hauling the dried stalks over ensilage, but there comes the expense of shocking the former; therefore the question of harvesting is in favor of silage. A cubic foot of ensilage weighs about fifty pounds; therefore one ton only occupies forty cubic feet. A ton of hay in mow or stack occupies 525 cubic feet, or about thirteen times as much room as a ton of

silage, while a ton of cured-corn fodder requires much more space than hay.

If two tons of ensilage are equal to a ton of hay, then ensilage will require only one-sixth as much room as hay. So much for the simple question of economy in storage between the two methods.

CHAPTER XX.

THE SILO.

How Large to Build.

A FULL-GROWN cow will consume from one and one-half to two cubic feet of ensilage per day, but generally it has been found advisable to make one of three feedings a day of hay.

At one and one-half cubic feet per day, a cow would consume in six months (the usual length of time for feeding winter forage in Western New York), 270 cubic feet, allowing for waste, say 300 cubic feet. If we multiply 300 cubic feet by the number of animals we wish to feed, it will give the size that is required to build, in cubic feet.

The following table gives the capacity in tons of different-sized silos. It is reckoned at forty cubic feet per ton, and a ton to last a cow one month. That is about sixty-six pounds per day, which is a liberal feeding. The quantity is computed for six months, estimating fifteen tons per acre.

	Size.		Capacity.			
	Diameter.	Height.	Cubic Feet.	Tons Contained.	Cows Numbered.	Acres Required.
1	10	20	1,455	30	5	2
2	10	24	1,745	43	7	3
3	12	20	2,160	54	9	4
4	12	24	2,532	63	11	4½
5	12	30	3,240	80	13	5
6	16	20	3,840	90	15	6
7	16	24	4,608	115	19	8
8	16	30	5,760	144	24	10

As to height, the modern ensilage cutters have carriers to almost any length, twenty-five to thirty feet if necessary. The silo should not be too large on top. It is best to uncover the whole at a time, taking off the entire top each day. This prevents cutting down with a hay knife.

Where to Build.

In locating the silo it should by all means be placed so as to open into the cow stable, and on a level with it, but not directly into the stable. The idea is to keep the odor from the barn except when feeding; that is, in a barn for dairy cows, as the milk, while being taken from the cows, absorbs the odor, and has been the cause of condemned milk from ensilage-fed cows. This contamination comes from the odor in the barn and not because the animals feed on ensilage. If the number of cows will warrant it, the silage can be delivered from a wagon the same as the summer soiling crops. The silo should be so placed as not to interfere with drawing through

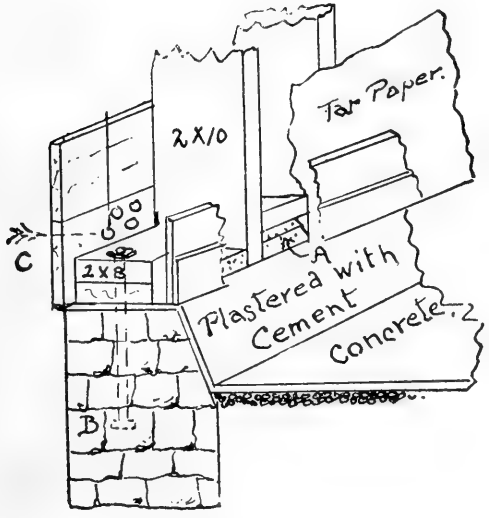
the barn with soiling crops, and for getting out with manure.

How to Build.

There are so many different ways of building a silo that it will be impossible to mention them all. I shall only speak of the most general methods.

Of Masonry.—We built two silos of brick, holding 160 tons each, at Murray Hill, and they gave excellent satisfaction. This was in 1883, and they are as good to-day as ever. Possibly a masonry silo will be found the cheapest in the end.

Of Concrete.—Six to eight parts gravel to one of cement. This is built by pouring or dumping the



mixture between planks placed on edge, and supported by braces and upright timbers to keep the

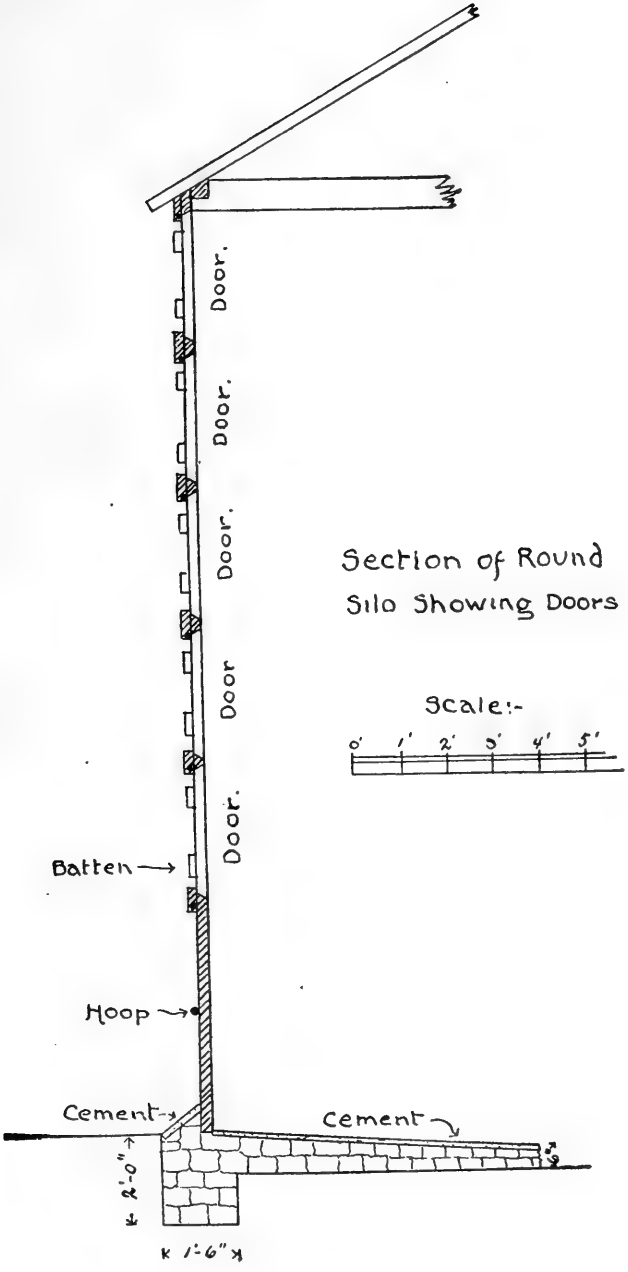
planks from spreading. This makes a very serviceable wall, and an inexpensive one, especially where the owner has the gravel at hand. A wall of this kind should be eighteen inches at the bottom, and taper to twelve inches on top, and be built plumb on the inside.

The Square Wooden Silo. — Studding, double boarded on the inside, with building or tarred paper between the boards, is recommended by some. Others say they rot out quickly. The space between the studding should run up and down and should be well ventilated from the outside. If this precaution is taken the boarding will last a number of years. The outside may be covered with single board or double, as the owner may think advisable.

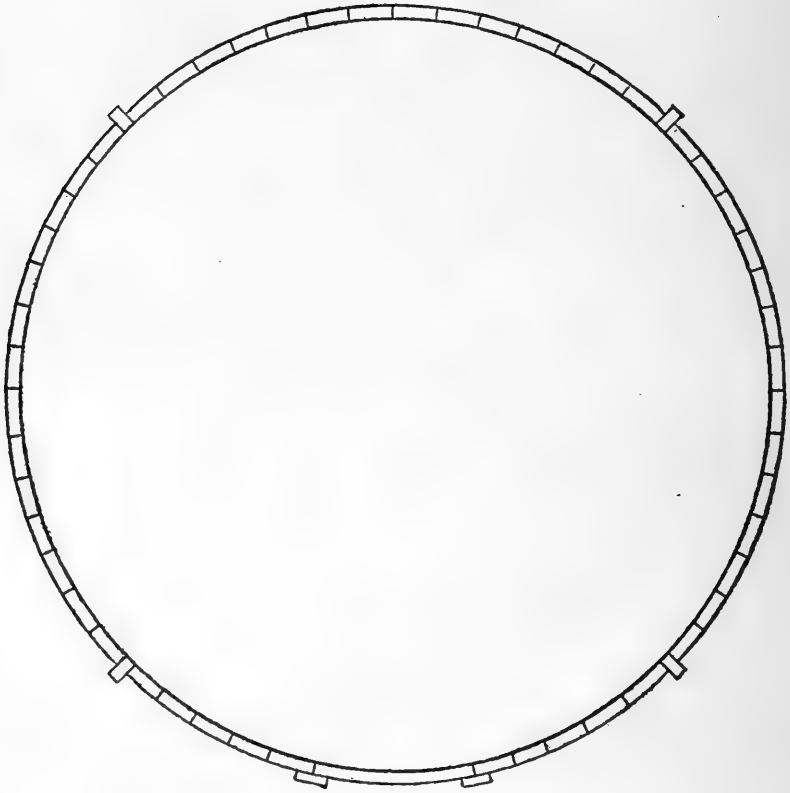
The Round Silo.—This seems to be the favorite plan of late years, and they are constructed in numerous ways. Half-inch boards sprung to fit upright studding, put on double thick, breaking joints, with building or tarred paper between, and clapboarded outside.

Others make several circular joists out of inch boards nailed together, and use matched boards for the inside, nailed up and down.

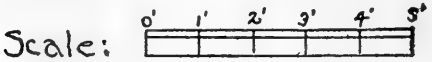
Stave Silos.—This seems to be the favorite of the wooden structures. I have seen many of these stave silos, and the one I would copy is built as follows, on a leveled cement wall, built as shown. Set on end four or six or eight (according to diameter of silo), 2×4 inch oak scantlings or other hard wood, planed. Bend the five-eighth inch round steel rods


Door.
Door.
Door.
Door
Door.
Batten
Hoop
Cement
Cement
2'-0"
1'-6"
Section of Round
Silo Showing Doors
Scale:-
0' 1' 2' 3' 4' 5'

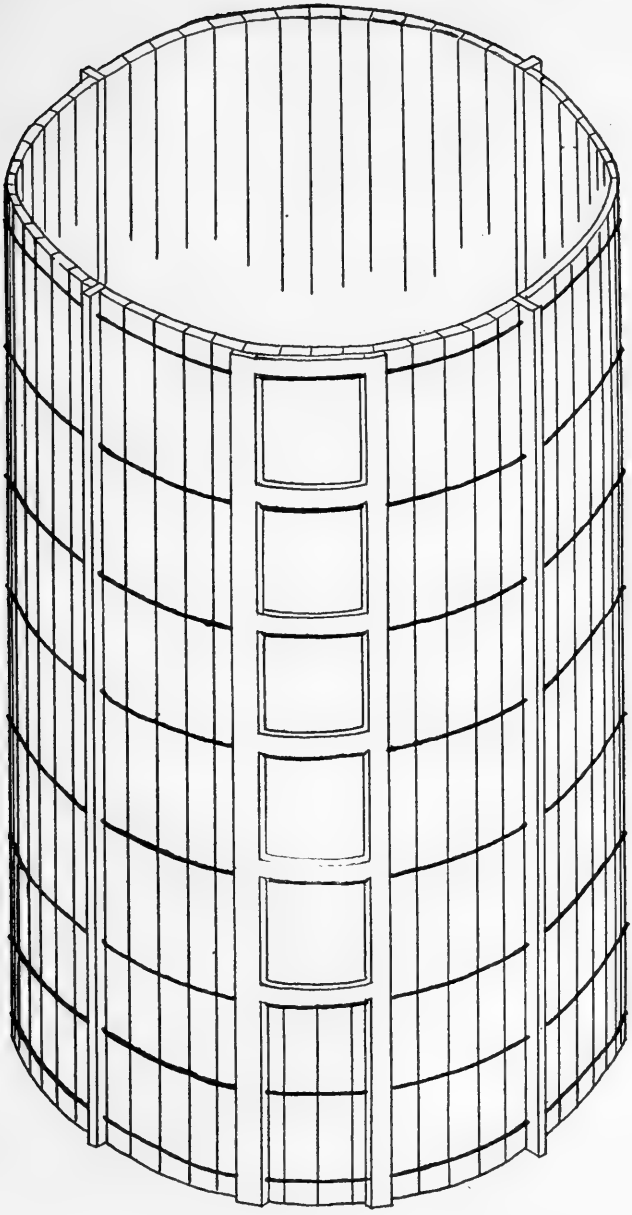
that form the hoops to the circle of the silo. Bore holes through these 2 × 4 scantling for the hoops to pass through. The scantling is set edgewise



Plan of Round Silo.



and forms a stave of the silo, as shown. When these are hooped and set up, the setting up of the staves on the inside will be a very easy task. These



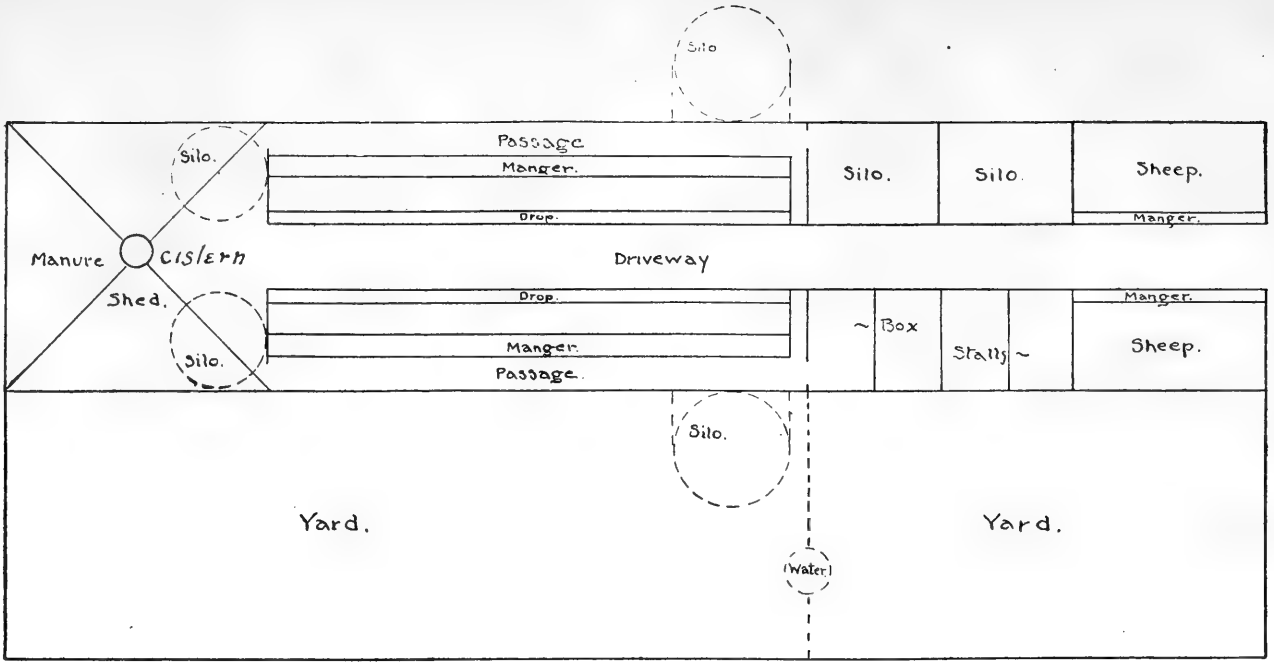
Round Silo.

hoops are made in sections, three or four pieces to each hoop, and are afterward drawn together by nuts on each end, not shown in the cut, as they come through the two by four. The doors or openings are nailed to a batten, shaped to fit the circle. They are then sawed out, and an inch board is put on, as shown, to form a jam. The doors are taken down as the silage is fed out.

There are lumber firms in all parts of the country that make a specialty of furnishing the staves any desired length, and the iron hoops for completing the same. They are nothing more nor less than stave cisterns built plumb. As to the cost, if the stave silo is enclosed, there is little difference in the cost of the three styles. It would be useless to give figures, as the price of lumber differs, and what would be a guide for one would not answer for another.

General Plan of Barn and Stable.

The following plan for a barn and silo suitable for summer soiling is shown on page 223. This barn shows two concrete silos, and dotted lines for two stave silos, one on each side of the barn, in case it is desirable to stand the cattle facing in opposite directions. If it is thought more advantageous to stand the cattle facing each other, the two silos may be built at the end of the barn, as also shown by dotted lines, in which case the manure-shed will have to be moved further to the left. The question of



Plan of Barn.

Scale:- 0' 5' 10' 15' 20'

which way the cattle had better stand may be decided by the method of handling the manure. If the stables are to be cleaned daily by wheeling the manure in a barrow to a compost pile, then the cattle better stand facing, so as to be most convenient for feeding the soiling crops, which, of course, must be brought in on a wagon. Where the barn is already built, and there is not room for a drive through from end to end, the cattle may stand in rows crossways of the barn, or the soiling crops may be driven into the barn on the floor above, and fed down to the cattle in a shoot. With silos at the end of the barn, the silage may be thrown into a wagon from either silo through a shoot, and thus carted in front of the cows, and fed directly from the wagon into the mangers, in case the cows stand facing the floor, which is on a level with the top of manger, as is the four-foot passage shown on page 223.

Stacking Ensilage.

The method adopted in England has been to stack the ensilage, but the practice never became general, as they do not grow maize or Indian corn, and only the grasses, clover, oats, vetches, etc., are treated in this manner when the seasons are unfavorable for curing them. While any green plant may be ensilaged, corn is probably the only crop that will ever find universal favor for that purpose. The stacking process with hay is a most laborious process, and, therefore, has not come into general

use. The stacks are usually provided with some sort of an arrangement for pressing the forage.

That it could be done in this country is evident. Two canning factories in Mount Morris, N. Y., stack their pea vines, corn husks and cobs. These factories ensilage the husks of over a thousand acres of corn yearly, and winters feed out this stacked refuse to several hundred bullocks. The pea vines from nearly as many acres more are stacked in the same way (whole).

This year one of the factories ran the refuse through a cutting box into a rough plank silo about thirty feet in diameter. The planks were rough just as they came from the saw-mill, set on end, and hooped with half-inch round iron. No roof was put on, and when the silage settled, the staves were taken down, the silage stood, and the whole mass kept in perfect form. Next year the staves (2 by 6 inch plank) will be set up again. As to its spoiling, there is six or eight inches on the sides that rots, and is thrown into the manure heap. As to freezing, they experience no inconvenience from that. If the top freezes a little, it is mixed with the unfrozen; fermentation sets up, and the frozen part is thawed out by its own combustion.

CHAPTER XXI.

GROWING ENSILAGE.

Amount of Land Required.

Twenty tons per acre is a good average crop on land in a good state of cultivation. The yield per acre varies from twelve to fifty tons. If you have built a silo with capacity for your herd as above, it is easy to compute the number of tons it will require for six months' feeding at forty cubic feet per ton. As to how many acres you will require, that all depends upon the fertility of your soil, and the only way to tell is by trying. Make a liberal estimate, If you have too much, it is not necessarily wasted. It can be shocked and husked as field corn.

Preparing the Ground.

If possible, plow in the autumn and sow to rye. Top dress the rye during the winter direct from the stables. Set stakes so as to continue on snow if necessary. Next spring plow the rye under, and as described in chapter on green manure, page 18, this green crop of rye plowed under will be the cheapest possible fertilizer, accumulating for you all the fall, winter, and spring. In this manner,

one field, the most convenient to the barn and silos, may be kept growing ensilage fodder for years in succession.

Plow deeper in the spring, the deeper the better. Put on three horses and do the work thoroughly. Prepare the soil as for field corn, and sow with a grain drill rigged as described for sowing corn for soiling crops, only the rows should be three feet apart. Sixteen quarts of seed per acre, or twelve quarts if sown three and one-half feet apart.

Roll the ground before and after drilling, and cultivate two or three times with a smoothing harrow, teeth set slanting back, or a broadcast weeder.

When corn gets too high for these, go through once or twice with two-horse or single-horse cultivator.

Variety.

Personally I prefer the common Western Dent varieties of medium growth, a kind that ears well, to the larger, coarser, Southern varieties, which may produce more tons per acre.

Harvesting.

With fifteen or twenty acres of ensilage fodder, no one can afford to be without one of the several corn harvesters, which will be found most handy in harvesting corn and sorghum for summer soiling as well.

A low truck wagon or a low rack between the wheels of a high wagon are quite essential to the

handling of the fodder. A good plan is to use three wagons and two teams. A load is brought to the cutting machine, and driven alongside. Two men are required at the cutter, one to unload, the other to feed. The driver leaves his wagon

Showing the McCormick corn harvester cutting corn on newly tile-drained ground in field where the draft trials were made.

there, and goes to the field with one that has just been emptied. The driver loads his own wagon. This makes four men to deliver the fodder to the silo, and one man inside to keep it level and thoroughly tramped around the edges, the engineer and the man who runs the harvester. The cutting may go on for a day or two before the filling begins. The wilting of the fodder will do no harm (a heavy

rainstorm probably would). Some deliver the fodder to the cutter in one-horse dump carts, dumping the load at the cutter, and returning to the field.

Filling the Silo.

A chute should be arranged to receive the silage as it comes into the top of the silo, and be so set as to cause the silage to fall in the center of the silo, for two reasons: if the silage is delivered into the silo from the carrier direct, the larger and heavier pieces are thrown out from the rest, and are, therefore, more or less separated on landing inside. This should be avoided. Again, if the silage falls into the middle, and is allowed to form a stack there, the man who distributes the silage to the sides has all downhill work, and no attention need be paid to tramping except just around the edges.

The tramping of the edges is best accomplished by a man standing with his back to the silo wall, and taking short side steps around the silo, then spreading out another layer, say, a foot thick or more, from what is accumulating in the centre, then treading again.

The idea of keeping a lot of men in a silo and sometimes a horse to tread is superfluous. If the silo is large and the cutting very rapid, before the men quit at night or before starting next morning, all hands can go in for a few minutes and help, or when there are a few minutes to spare between loads, the cutter, and feeder, and engineer, if there is one, can

give a hand. There is invariably a delay some time during the day that can be worked to advantage in this way.

Power.

In some sections there are men who go about with ensilage cutter and a threshing engine, and supply the extra help the same as for threshing; and as ensilage harvest comes after most of the grain threshing is over, there is usually no difficulty in securing an engine to do this work.

A two-horse tread power will operate a good-sized cutter, but it seems like too much work, besides the horses are all wanted in the field at this time. An eight horse-power engine is best, as it only requires four to six horse-power to run a very large cutter. The engine is easily attended to, and the engineer can often give a hand at feeding, treading, etc.

Pressing.

It was formerly thought necessary to weight the silage heavily. At Maple Lane farm, 1880 to 1883, we had two feet of stone on a plank covering. At Murray Hill in 1884, we made concrete blocks about eighteen inches square, and hoisted them in and out with a hand derrick.

Nowadays little attention is paid to weighting; a few inches of cut straw, and a plank covering are about all that is necessary, and the majority do without that. Silage is heavy. A good day's filling has weight enough in itself to press all below it.

It is the carbonic acid gas which it generates in the process of fermentation that is relied upon to preserve the silage. This is heavier than air. The first stage toward decay is the lactic, then the alcoholic, then the acetic. At this point, if the air is replaced by the carbonic acid gas which this stage of decomposition produces, the air, as before stated, is expelled and fermentation ceases. The next stage to the acetic is decay. When the silage is removed from the silo and comes in contact with the open air, fermentation begins where it left off, as indicated by the heat that is speedily generated.

The only pressing that is necessary, if any at all, is to put on enough to press together or exclude as much air as possible from the last two feet of silage. It is a good plan to leave one or two days' cutting to put on top after the silo has settled. Or, where there are two silos, they can be cut into alternate days.

As to slow or rapid filling, there is little to be said in favor of either.

The question of the quality of the silage, I believe, is not owing at all to whether the silo was filled fast or slow, but to the condition of the corn itself when the harvesting begins. I have ensilaged corn in its greenest possible stage, before there was a sign of a leaf, when the ears were not yet fit for roasting or boiling; also when the ears were glazed and the leaves were dying, and still later when it was fit to cut and shock, ears ripe, husks ripe, bottom leaves ripe; then again after a severe frost, and again

with sweet corn after all the ears had been plucked for the canning factory. Some farmers cut and shock their ensilage, and after standing for a month or six weeks in the field, they ensilage it, and even then it makes good silage. I have had as sour ensilage from slow as from rapid filling, but the stalks were in both cases green. The poorest silage, sour, bitter, watery stuff, was from the first mentioned, the second was better in this respect, and the third best of all.

This leads me to say that corn for ensilage should be sown from three to three and one-third feet apart, according to size of variety, so as to allow it to very nearly, if not quite, ripen as you would for cutting and shocking. The thoroughly ripe corn makes better ensilage than the green. There is, from the moment the ear reaches maturity, a decided loss in feeding value of the stalk, as shown by the following:

Time to Harvest.

New York Experiment Station, 8th Annual Report.

"Yield per acre, and the per cent. of water for each period:

	Pounds Per Acre.	Dry Matter.	Per Cent Water.	Tons Water Per Acre.
July 30th, full tasseled	18,045	1,619	91.05	8.21
August 9th, full silked	25,745	3,378	88.05	11.33
August 21st, kernels in milk	32,000	4,643	85.76	13.97
September 7th, kernels glazed	32,295	7,202	77.70	12.51
September 27th, kernels ripe	28,460	7,918	72.18	10.27

"Professor Roberts, of Cornell University, says: 'Fodder corn sown broadcast does not meet the needs of milking cows. Fodder corn is mainly a device of a thoughtless farmer, to fool his cows into believing that they have been fed when they have only been filled up.'

"While the tons of water decreased as it neared maturity, the dry matter steadily increased. From the first date to the last the dry matter increased 4.8 times, *i.e.*, 1,619 to 7,916 lb. per acre, while the digestible albuminoids increased."

	Starch Per Acre.	Digestible Albuminoids.
July 30th	122.23	117.37
August 9th	491.25	205.79
August 21st	706.74	207 03
September 7th	1,734.96	315.42
September 27th	2,852.96	326.21

CORN PER ACRE.

	Albuminoids.	Carbohydrates.	Fat.
July 30th	239.77	1,168.10	72.20
August 9th	436.76	2,272.19	167.75
August 21st	478.69	3,703.26	228.90
September 7th	643.86	6,005.67	259.99
September 27th	677.78	6,561.64	314.34

"Corn in the shock loses thirteen to fifteen per cent. of dry matter."

COVERING.

Bran as a Covering.—Mr. Henry Woods, of England, was the first, I believe, to suggest the practice of covering the ensilage with bran. He says: "I

chose this covering in order to exclude the air by a cleaner and also a more effectual mantle than soil. A shrinkage goes on, soil has a tendency to crack, making openings that admit the air, and some portions of the soil, at least, work down into the ensilage. Moreover, there is the immense advantage of perfect cleanliness combined with usefulness." He wrote this in 1883. In 1884 he says, "Further experience has confirmed me in this view, *i.e.*, a layer of bran over the boards not less than four or five inches in depth is the best possible covering."

He adds in substance, by way of caution, that some have fallen into a great mistake of putting the bran under the planks instead of over, in which case the bran was injured for feeding purposes.

The method that seems to have met with most universal favor in the States is to cut or spread over the top grass, then boards or planks. Others have covered with plank and earth, and report most favorably. Others still have put no covering at all over the silage except boards, while still others claim that the silage keeps better if planked and weighted.

CHAPTER XXII.

FEEDING ENSILAGE.

Amount of Ration.

Ensilage is not a perfect food, we are told by the chemist, and to make it so requires (per cubic foot) a few pounds of bran, crushed oats, oil-cake meal, or one feeding a day of cured oats and peas or clover hay. As to the amount of grain to be given with two feedings of ensilage and one of clover hay, that depends entirely what we are feeding for, the dry cattle and young things will thrive on ensilage morning and evening, and clover hay or oats or peas at noon. If it is desirable to make winter butter, a ration of the above mixture in the following proportions will be found about right: three parts bran, two parts crushed oats, and one part of oil-cake meal (old process preferred). My experiments with so-called balanced rations have not been as satisfactory in practice as in theory. I am quite satisfied with the above feed. As to the amount of silage to feed morning and night, give all they will eat up clean. The feeder will soon learn how much to give of grain or silage. The best rule is to keep giving grain as long as a cow responds to it. When

you have reached that point, you have found your animal's capacity, and there stop. You will require a pair of scales to weigh each milking, a Babcock to make occasional tests. With these at hand, you can easily find a cow's capacity. To this she should be fed to make her most economical. No one can make a cast-iron feeding ration. Only an intelligent feeder with scales and test at hand can find a cow's capacity, and you will be surprised to find that two quarts of the above mixture a day is one cow's limit, and sixteen quarts a day can be taken care of by a cow standing next to her. Balanced rations are, no doubt, all right theoretically, but there comes in capacity of the cow, strength of machinery. A small cow may be, and they generally are, better and more economical feeders than large ones. It takes, we are told, two per cent. of the live weight a day of hay or its equivalent to sustain life. A cow weighing 1,000 lb. will require twenty pounds that go to run the machine. A cow weighing 1,500 lb. requires thirty pounds a day, ten pounds a day more to support that extra 500 lb. of carcass. Ten pounds a day could be put to better use by being fed to the 1,000 lb. cow. Ten pounds a day is 3,500 lb. a year, or one and three-quarters tons of hay or its equivalent. At $12 a ton this equals $20 a year, just to support that extra 500 lb. of carcass that is no earthly use to the cow or owner until she goes to the block. A 1,500 lb. cow must yield $20 a year more than a 1,000 lb. cow to pay as well, all other things being equal. This is no fancy sketch. It is a question

easily demonstrated, and when a breeder or a dairyman begins culling out his cattle to those that pay the best for the amount of food consumed, he will, as a rule, discard more cows that weigh over 1,000 lb. than under. So much for feeding. No rule can be given. Each cow must answer for herself.

Cost of Production.

On this subject there is a very wide difference in the estimates sent into the agricultural papers, all the way from 30 cents to $2.00 per ton. I may give the following as an approximate estimate of the cost of growing and harvesting one acre, producing thirty tons, which is a very good yield, and a very good day's work to harvest it:

Plowing, seeding, cultivating	$5.00
Seed, twelve quarts, 60 cents per bushel	.25
Harvesting, three laborers in the field.	3.00
Three laborers at silo	3.00
One engineer, engine and fuel	5.00
At thirty tons per acre	$16.25

This makes a cost of 54 cents per ton, to which should be added, if you wish to get at the full cost:

Brought forward	$16.25
Manure, estimated	5.00
Use of three teams, one cutting, two hauling, say	5.00
Use of grounds	5.00
Use of tools and silo	5.00
	$36.25

This brings the total cost at about $1.20 per ton. The above does not signify very much either way. Some may find my figures too high and others too low. My ensilage has never cost me much over 50 cents per ton, as shown in first table.

CHAPTER XXIII.

SOILING VS. ENSILAGE.

Comparative Value.

It has been advocated by some enthusiastic ensilage men that, instead of soiling cattle in summer, ensilage should be fed the year round.

This opinion must certainly come from enthusiasm, for in reality there are small grounds on which to sustain such an argument. I have already said soiling is as far ahead of ensilaging as ensilage is ahead of cured fodder. First, there is a loss of feeding value in silage amounting to about twenty-five per cent. Second, soiling is more economical in point of extra labor (that many seem to think is so great). Soiling crops go direct from the field to the cattle.

Ensilage has to be cut and deposited in the silo, then taken out again. All this labor is omitted in case of soiling crops. Again, oats and peas, barley, rye, the clovers, are more nearly a perfect feed in the green state than corn, even before it has lost twenty-five per cent. of its feeding value in the silo.

Again, the change from silage to fresh-cut oats and peas, for instance, is a very welcome change, and has never, in my experience, failed to increase the flow of milk. True, there is a little saving in

securing the ensilage at once, but not as much as is imagined.

There should always be enough ensilage to more than last through the season. The new crop can be put on top of what is left without the slightest injury to either.

CHAPTER XXIV.

CONCLUSION.

System.

There is one thing especially necessary in conducting the soiling system successfully. It is not capital as some might suppose, for men without capital are usually the first to adopt it. It is also unnecessary that a man should have a large farm stocked and equipped, because the system is equally well adapted to a limited number of acres.

Nor will only those be successful who live near large cities, where land is high. Whatever may be the condition of the land, it is safe to say than the amount of land that will keep one head by pasturing will keep four or five by soiling. The rule works as well on cheap land as on high-priced land, the latter not being necessarily more productive than the former. Therefore, if from land worth $25 per acre, a farmer sells as many dollars' worth of produce as on land near the city worth $200 per acre, the soiling system is as profitable to the one as to the other. The difference in the profit from soiling will be found from the productiveness of the soil, and not necessarily in the price of the land. If on a farm worth $100 per acre a farmer can keep one

cow one year from an acre of land, and another, whose farm on account of its location, is worth $200 per acre, but is only capable of keeping one cow a year upon two to five acres, the profit in soiling is greatly in favor of the farmer with the cheaper land, so far as keeping cows is concerned.

This is mentioned because it is so often stated that "it may pay to soil where the land is high-priced," and to show that the price of land is not a sure indication that soiling will be found successful in proportion to its cash value. We can imagine, however, a farmer, under the most favorable circumstances, failing to obtain satisfactory results from soiling, for the want of system.

Without system a farmer may soon become disheartened, and pronounce the whole thing impracticable; for instance, by omitting to sow at the proper time, or the proper amount. Sowing too much at a time, the stock are unable to consume it in its most succulent state, continuing to feed until it becomes tough, when it is only eaten to satisfy intense hunger. By having too little, his cows must be turned into the field until the next crop is in condition, thus causing him to become dissatisfied.

Again, we can imagine a man with plenty of feed, putting, at one feeding, sufficient before his cows to last them all day; they breathe upon it for a few hours, and nothing short of severe hunger will induce them to take it, in which case his stock would shrink in the flow of milk, and increase on turning them to pasture, which would lead him to say that

the cows did better at pasture, and thus condemn the system.

Again, by not having properly constructed stables or stalls, they might become very filthy or unhealthy, and the cow would long for "pleasant fields and pure air," and this might lead the farmer to abandon the system.

Again, his manner of cutting and feeding might require more labor than the advocates of the system profess, and he might thus think that the system might be well enough for a farmer with plenty of capital, a "fancy farmer," a "book farmer," but not for him.

Again, by his undertaking too much at once, and getting everything mixed up. The last state of that man would be worse than the first.

But by so systematizing the work that every want will be supplied, any farmer can feel sure of success. He need not necessarily follow the plan in detail that is laid down in the previous pages, for it is not so perfect but that it may be improved. If closely followed, the system will lead to success; therefore, I may be pardoned for saying that until he learns by actual experience a better way, the beginner is advised to adhere to the plan pointed out in all its essential points. Many things that looked as if they would result in improvements, when put to the test, will be found wanting. The principal requisite to success by soiling is system.

The work of sowing, cutting, and feeding should all be placed in the charge of one person, who can

be relied upon to do the work as directed; and when the daily routine is once established, it will be found much less laborious than it seems to be. The labor is comparatively light; it may be performed by a stout boy where the number of cows does not exceed twenty-five head, but nothing should be left to chance.

When the proper time comes for sowing, the work must be done. The cutting must also be attended to when the crop is ready. The feeding also must be regular and uniform in quantity.

With a little practice, and if a person is not entirely destitute of ability to work systematically, he cannot easily fail of conducting the soiling system with profit, and also to enjoy the many advantages which it affords. I have never heard of a man who having once thoroughly adopted the system, was not, ever afterward, decidedly pronounced in its favor.

Education.

As Mr. Stewart says, in conducting the soiling system successfully, "the need is more for head work than for hand work."

I believe that he might have extended the remark to every branch of agriculture, especially where the price of land is necessarily high. The day has gone by in the older States when a man can follow farming, because he does not know enough to do anything else. It may be done in the West, where land may be had for the asking, and so productive

that by "the slightest effort it will produce an abundant harvest;" but in the East it is not only essential that the farmer should possess a knowledge of how to produce a crop from the soil, but how to leave the soil in as good condition as before the crop was taken, or better. This, in my opinion, is good farming; while he who harvests a crop at the expense of the soil is not a true husbandman.

Farming is an honorable profession, but he who tries to obtain by it something for nothing is never a credit to his profession. There seems to be among some classes of farmers a great antipathy to what they term book farmers. Why may every other man learn what pertains to the advancement of his business from books, and not the farmer? We point with pride to this man or that man in the medical profession, and say that he is a well-read physician; to a lawyer, and say that he is a well-read attorney; to a citizen, and say that he is the best-read man in the place. These are chosen and preferred for their learning, and their excellence is measured by the number of books they have mastered.

Again, why should farmers subscribe for two or more papers devoted to politics, religion, or science, and read them diligently, papers devoted to every subject but one? Why purchase books of fiction, books pertaining to all subjects but one, and that one his own business? Why does he consult his neighbor as to his methods of growing a certain crop, and follow his example, when, if the neighbor

should write out his experience in book form, it would be denounced as book farming? Whence do farmers' sons get the idea that, as soon as they obtain an education, there is no use for it on the farm? They are sent to school, taught chemistry, botany, engineering, and surveying, but from their fathers' examples they have learned to think that such an education may do well enough for a book-keeper or a dry-goods clerk, but to apply such knowledge to an agricultural pursuit is all wrong; it is book farming, and yet it is knowledge that can be put to practical use on the farm.

Do farmers mean to acknowledge that their profession requires less intelligence than others?

What is there in farming that requires a man to be ignorant? Must a farmer, in getting on in the world, move backward like a crab, or as Mark Twain says of the inhabitants of the Azores Islands, among whom all efforts to introduce new and improved methods of farming have failed: "The peasants crossed themselves, and prayed to God to shield them from all blasphemous desire to know more than their fathers did before them"?

These questions I will leave the reader to solve. However, I will venture to suggest as a remedy, a better education for the future farmer. The great problem of feeding and clothing the millions depends upon the success of agriculture, and requires of its followers a knowledge that embraces a wider and more liberal education than any other pursuit.

Said the late President Garfield: "At the head of

all the sciences and arts, at the head of civilization and progress, stands, not militarism, the science that kills, not commerce, the art that accumulates wealth, but agriculture, the mother of all industry and the maintainer of human life."

Farmers' Sons.

It must be admitted that agriculture at the present time has much to discourage the farmers' sons and daughters; but the outlook for the near future is brighter. Soon our government lands will all be given away. At no distant day, the cities, at the present rate of increase (compared with agriculture), will consume all our own farm products. This day is hastening on like a candle burning at both ends; the Government burning at one end, the Western immigrant farmers, who are rapidly reducing the fertility of their land, are hastening the good time from the other end. There is surely a good time coming. A day is dawning when agriculture will once more take rank, as she deserves, among the noblest and highest professions.

Let me admonish you to stick to the old farm a little longer, and try soiling.

FINIS.