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THE FARMER'S INTEREST IN GAME PROTECTION.

BY EDWARD HOWE FORBUSH.

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THE FARMER'S INTEREST IN GAME PROTECTION.

EDWARD HOWE FORBUSH, STATE ORNITHOLOGIST OF MASSACHUSETTS.

Introduction.

It is unfortunate that so many farmers evince little or no interest in game protection. Some regard game laws as of no advantage to the farmer, but rather as class legislation for the benefit of the sportsman. Nevertheless, the protection of game affects the agriculturists more vitally than any other element of our population. The farmers own the greater part of the land, and the game is more accessible to them than to any other class, for they live upon the land where the game is. Game conservation is advocated under our present system not solely to furnish sport for a limited number of individuals, but to protect the useful species of birds and mammals for the benefit of the whole people. Rational game protection should so work out as to restrict injurious species to some extent, to protect the land owner against law-breaking, trespassing hunters, and to create a community of interest between the farmer and the sportsman. The principle that game is the property of the State is now well established, and has been sustained by the higher courts; but by means of laws against trespass, which have been enacted simultaneously with the game laws, the farmer who posts his land against hunters or trespassers has been given practical control of the game so long as it remains on his land, and the exclusive privilege of hunting it there during the open season.[1] In Massachusetts he is even allowed by law at any time to kill deer that are injuring his crops, and also to collect damages from the State for such injury. Game laws tend to limit the number of hunters and to shorten the season during which hunting is legal. They also protect most insect-eating birds at all times, and abolish the trapping and

[1] The possession of a hunting license gives no privilege to hunt on the posted land of another.

netting of game. Were it not for these laws, the farmer would be continually annoyed by the tramping of hunters through his fields at all seasons, the tearing down of his pasture walls and fences and the shooting of birds in the nesting season.

Some game birds are very valuable to the farmer as destroyers of insects and other pests; some game mammals, on the contrary, are sometimes destructive to his crops or trees; but the farmer who takes advantage of the laws enacted for the prevention of trespass, the protection of crops and the conservation of game and birds, may thereby add to his prosperity as well as to his pleasure in life, and by fostering the increase of fish, game and birds he may make life more attractive to his boys, and thus help to keep them on the farm. This paper will be devoted mainly to the material advantages that the farmer may derive from the protection of wild game, and particularly game birds.

Economic Value of Game Birds.

High among the valuable destroyers of insects and weeds we must rank the bob-white, commonly known in New England as the quail. This bird has not only an esthetic value, by reason of its bright, lively presence and its cheery call; but it is also one of the chief feathered helpers in field and garden.

Dr. Judd of the Bureau of Biological Survey gives some interesting records obtained by a study of its food.[1]

The contents of the stomachs of 801 bob-whites were examined by the experts of the survey; over 50 per cent of the food consisted of seeds, the bulk of this being weed seeds. One bird had in its stomach 1,000 seeds of rag weed; another had eaten no less than 5,000 seeds of the troublesome pigeon grass. As each bird eats two or more meals a day of this character during the season when weed seeds may be found, a few flocks of such birds might do much to limit the production of weeds on any farm. Dr. Judd estimates that the bob-whites of Virginia consume 573 tons of weed seeds between September 1 and April 30. Examining the insect food of this bird, he finds that many of the most important insect pests of the United States are

[1] Judd, Sylvester D. The Economic Value of the Bob-white. Year Book, United States Department of Agriculture, 1903, pp. 193–204.

eaten in quantities. Cucumber beetles, bean leaf beetles, May beetles, click beetles and their progeny the wireworms, weevils, potato beetles, spinach flea beetles, grape vine beetles, corn bill bugs, chinch bugs, cut-worms, cotton worms, boll worms, southern tobacco worms, army worms, garden caterpillars, grasshoppers, locusts and ants are found in its bill of fare. It is one of the few birds that are very destructive to the Colorado potato beetle and the chinch bug. Without question the bob-white is one of the birds that the farmer should strive to protect. The ruffed grouse, the heath hen, the wild turkey, the introduced pheasants, the woodcock and the snipe, — all have a greater or less value as insect destroyers, and most of these birds feed upon the seeds of weeds.

Wild ducks may be of great service during any outbreak of insect pests in the fields. They are destructive to mosquitoes, grasshoppers, locusts and army worms. Most of the non-game birds of the farm are particularly beneficial. In a report of the Secretary of Agriculture on the work of the Biological Survey, transmitted to Congress with a special message by President Roosevelt on Dec. 21, 1907, it is estimated that the sparrows of the United States saved the farmers of the country in 1906 $35,000,000 by the destruction of weeds; and that a single species of hawk saves the farmers of the western States $175,500 a year by the destruction of grasshoppers and field mice. It will pay the farmer, therefore, to promote the protection of nearly all the birds of the farm, and to lend his influence to the enforcement of the game laws and bird laws, for the birds that are distinctly injurious are not protected.

The Economic Value of Game Mammals.

The native game mammals of Massachusetts consist of squirrels, hares, commonly called rabbits, and deer. The woodchuck, raccoon, fox and other predatory or destructive mammals, although hunted, are usually classed as vermin by the gamekeeper, but some of them yield valuable fur. Squirrels are of some service as tree planters, for they distribute the seeds of nut-bearing and cone-bearing trees far and wide; also they destroy insects, for a time, in the summer. Under protection, however, they are likely to so increase in numbers as to become destructive to birds, nuts, fruit and grain. Rabbits, when numerous, destroy young trees; and deer, under the same conditions, attack young fruit trees and vegetables. Therefore the farmer has not the same economic incentive for conserving mammals that he has for protecting birds. Nevertheless, all these animals add to the attractiveness of country life. And if the laws are so framed as to give to the owner of the land an opportunity to protect his property from their inroads, and to take a reasonable number for food, the game mammals may be considered as of considerable value to the farmer.

Financial Benefits derived from Game.

Under the present laws the game on the farm may be so conserved and handled as to bring in an annual cash revenue to the farmer. Owing to the laws which prohibit the sale of wild game birds, these birds cannot be marketed. Ordinarily, however, the farmer will find it more profitable to lease his land for shooting purposes than to sell the game in the market. Associations of farmers and sportsmen have been formed, in which the farmers grant shooting rights on their property to a limited number of sportsmen, and the sportsmen agree to protect the farm property from poachers. In other cases the protection of the farm property is left to the farmer. In Rockford township, Illinois, a farmers' association was organized in 1901, each member of which had the right to grant to any one the privilege of hunting on his farm in his company. All undertook to promote the strict enforcement of the game laws. Seventy-five members were enrolled, representing 12,000 to 15,000 acres of land. The system under which this association worked was so complete that poaching and trespassing were nearly eliminated. Notwithstanding the shooting done, prairie chickens and quail increased in numbers, while insect-eating birds became abundant.[1]

A somewhat similar system is in operation in North Carolina. Exclusive shooting privileges over farm lands are secured by

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[1] Palmer, Theodore S. Some Benefits the Farmer may derive from Game Protection. Year Book, United States Department of Agriculture, 1904, p. 518.

the sportsman either by paying the owner a certain sum per acre, or by paying all taxes on his real and personal property. The sportsman or the sportsmen's club may thus lease several farms. The lease does not interfere in any way with the rights of the owner to cultivate the land, or with his residence thereon. Planting is encouraged. Many of the lessees furnish the farmers with cow peas or grain for planting, that the quail may have better food and cover, and this planting is often carried out on a large scale. Some of these lessees employ gamekeepers to destroy the natural enemies of the game and to keep watch for law breakers. Thus the farmer is relieved from some of the trouble and annoyance of guarding his property and prosecuting poachers. This system has become very popular among the southern farmers, and the game is regarded as one of the assets of the farm. In Guilford County more than 150,000 acres have been leased out in this manner, and there are in the State some large preserves, varying in size from 9,000 to more than 18,000 acres. This system, as applied in the south, has a tendency to better the condition of the agricultural population, and to give the children of the farmers better educational facilities. Under the laws of North Carolina special taxes are imposed for the support of the school system, and the farmers, realizing that their taxes are paid by the sportsmen, are more likely to vote additional funds for school purposes. Thus the game helps to educate the children.[1] This system has brought additional prosperity to the region, and has increased the numbers of game and birds. It gives the farmer opportunities to furnish boats and teams to the hunters, and he and his boys receive some employment as guides and helpers.

This system has not made much headway in Massachusetts, but farmers who have given it a trial are well satisfied with the result. A number of farmers in southeastern Massachusetts, who have learned the value of the bob-white, find that they can maintain a good stock of these birds by combining, and leasing the shooting rights. Their lands are not much wooded, and are more easily guarded against poachers and trespassers than the

[1] Some of the South Carolina lands are poor and rather barren, and where the rights for such lands are taken by the acre, the annual rental averages only about 6 cents per acre, — a sum which would look small to Massachusetts farmers.

wooded lands in some other parts of the State. This may account, in a measure, for their success.

The principal difficulty in finding lessees for shooting rights lies in the scarcity of the game, but this drawback can be remedied. Wherever the game is protected against excessive shooting, and where such natural enemies of the game as lynxes, cats, foxes, raccoons, minks, weasels, rats, crows and bird hawks are held in check by the gamekeeper, the game soon becomes abundant. In some cases it increases so fast that considerable shooting becomes necessary to prevent excessive increase and the consequent spread of infectious diseases, which are very fatal on an overcrowded game preserve. In this latitude the bob-white is sometimes nearly exterminated by severe winters; but much of this excessive mortality might be avoided by giving the birds a little care, protection and food in winter. The woodcock needs only suitable cover and protection. The ruffed grouse or partridge is hardy, and may be made numerous on any preserve which contains good cover and an abundant supply of food. The wooded hillsides of Massachusetts, interspersed with swampy hollows, are the natural paradise for this king of game birds; and there is much rocky and swampy land that is of little value for anything but the production of timber and game. The pinnated grouse or heath hen ought to thrive under protection on much of the sparsely wooded land in southeastern Massachusetts. The increase in the numbers of these birds on Martha's Vineyard since they have been made the wards of the Massachusetts Commissioners on Fisheries and Game gives hope that they may recover their lost ground. Snipe and certain shore birds will gather on any suitable marshes where they are not continually molested, while ducks may be attracted to ponds, streams or fens by a few call or decoy ducks, or by wild rice or a supply of grain for food.

The principal objection urged by the opponents of the system of leasing shooting rights and the establishment of game preserves is that the policy is un-American, and that it gives over the shooting privileges into the hands of the wealthy few, thus depriving the many of the right to take game that belongs to the whole people. It may be admitted that the system is un-

American, for the American policy of destruction which has been so successful in the past allows unlimited freedom to all to take or destroy every living wild thing upon the face of the earth. Such license was necessarily permitted during the time of settlement; but unless the people are restrained in their rapacious tendencies, as population increases the extinction of all wild game will result. Already the day of open and free shooting in the east has passed. The occupation of the market hunter has become precarious, and necessary laws have been enacted, — too late, indeed, to save some species of our game, but in time to prevent the destruction of others. As population increases, the number of shooters will increase; and the present system of game protection must and undoubtedly will be changed to follow somewhat that of other countries, which, although more thickly settled than our own, have nevertheless an abundance of game in fields and coverts as well as in their markets.

If we are to have game in the future, we must regulate hunting strictly, and adopt some system of game preserving, coupled with artificial propagation of game. The policy of licensing hunters, which has gone into effect in New England, will restrict the number of hunters, particularly the alien hunters; and this is a long step in the right direction. Ignorant foreigners, who come here without knowledge of our laws and with the idea implanted in their minds that liberty in the new country means license to do as they please, should not be allowed to shoot at all or to range the country at large, unless some means can be provided by which they may be controlled and identified. Many of these people shoot all kinds of mammals and birds for food, and the license fee of $15 exacted of them (for hunting) stops most of the hunting by this class; while those who continue to hunt must carry an identifying license, and have it ready for the inspection of the citizen or game warden. Aliens should be prohibited from hunting under all circumstances; but even with the alien eliminated from the field there will still remain an army of hunters so vast that, with free shooting allowed, the game will have little chance except in remote regions. In 1914 about 65,000 hunters were licensed in Massachusetts, and the number is constantly increasing.

Under our present system, the only salvation of the game is to prohibit its sale and thus remove the incentive for market shooting. Sale has been forbidden now by law except in the case of rabbits or hares. But with the advent of artificial propagation and scientific game preserving the sale of such species as can be reared in captivity or produced in large numbers on game preserves is permitted under restrictions imposed by the Commissioners on Fisheries and Game. Unless our farmers undertake the rearing of game, we shall soon have little game in our markets except such as is imported from foreign countries. The demand for game will continue, and it remains for our people to decide whether they will produce it here or send thousands of dollars abroad for it. Our country is so large that it is not probable that the greater part of it ever will be occupied by game preserves, as is the case in some European regions; therefore, the overflow from preserves will still afford shooting for the people in the country surrounding them. It is undoubtedly true that the rich have advantages over the poor under this system, as in many other respects, and they always will have certain advantages under any system; but it is also true that the farmer is in a position to derive some benefits from the expenditure of the rich man's money in support of a system of game preserving which, while it interferes to a certain extent with free shooting, provides an abundance of game in regions where without it and under the old system there would be no game at all.

The above is not written for the purpose of advocating any change in our system of game laws or to approve the European system of game preserving, but merely to point out the logical tendency of a movement which already has gained a strong foothold in this country, and to show the farmers the benefits that they may derive from the inevitable extension of this movement.

The Artificial Propagation of Game.

The rearing of native upland game birds in confinement is still a subject of experiment, and never has been made a financial success; but enough has been accomplished to prove that it is possible to rear the ruffed grouse, the pinnated grouse and the bob-white in domestication. Mallard ducks, black ducks, wood ducks, teal, Canada geese and a few other species have been reared successfully. When such birds as wood ducks and Canada geese find a ready market alive at from $5 to $15 a pair, or more, those who understand the business of rearing them ought to make a profit. Pheasants may be sold at similar prices, and at present they will bring about $3 per pair, food value, in some of our markets. Those who understand the business claim that the cost of rearing them is less than $1 each. Any successful pheasant raiser in Massachusetts ought now to be able to dispose of all the birds that he can rear. If the people take advantage of their opportunity, enough of these birds should be raised by farmers and sportsmen to make them plentiful in our markets. The ring-necked pheasant, which is the species most commonly reared, is not a conspicuous success as a wild game bird in Massachusetts; but it has succeeded better, under the adverse conditions surrounding game birds here, than has any other introduced species. It thrives best, however, if given some care and protection, and it needs to be fed in winter. As a half-domesticated game bird, artificially propagated, protected and fed by man, it is unexcelled. Its general distribution throughout the State under protection is not particularly desirable, for it is liable to diseases that are fatal to native game birds, and where it becomes numerous it is destructive to certain crops, and consumes the food of quail in winter. But if reared in inclosures while young, and allowed to run half wild on the grounds of the owner, it makes a very desirable addition to the supply of game for the table, and therefore will probably take the place in our markets of some of the native game birds now illegally sold.

A general open shooting season for pheasants will prevent them from becoming too numerous, and thus constituting a menace to our native game birds. In the meantime, those who wish to propagate or protect pheasants have now their opportunity.

Deer may be reared in pastures and sold alive at a profit. The rearing of game in inclosures or on preserves must be depended on to help in solving the problem of the game supply of the future.

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BEEF PRODUCTION IN NEW ENGLAND.

By Herbert H. Wing.

From the Sixty-second Annual Report of the Massachusetts State Board of Agriculture.

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BEEF PRODUCTION IN NEW ENGLAND.

HERBERT H. WING, PROFESSOR OF ANIMAL HUSBANDRY, CORNELL UNIVERSITY, ITHACA, NEW YORK.

I am asked to speak to you on the subject of beef production. I have taken the liberty to broaden the subject, and if you please, will attempt to discuss the whole question of meat supply in its relation to the New England farmer.

Much attention has been given to the number of meat-producing domestic animals in the United States, particularly since the Federal Census of 1910 called attention to the fact that there had been a sharp decrease in the number of such animals during the preceding decade. This was the more noticeable to the public, since the first sharp increase in price occurred at about the same time. Students and statisticians who had given attention to the question of meat production in the United States had long been aware of the fact that meat-producing animals were relatively decreasing, but as these matters were largely confined to trade journals and occasional references in the agricultural press, the general public remained to a large extent indifferent to them. It might be well for us to briefly review the condition of the country and more especially of New England with respect to the numbers of meat-producing domestic animals, and since dairy cattle are intimately associated with meat-producing animals and the meat-producing industry, these have been included as well. In order not to burden you with extensive quotations of statistics, I have arranged the most important figures on a chart, so that you may the more readily see at a glance the more important facts.

CHART No. 1. — *Live Stock in the United States.*

	1900.			1910.		
	Number.	Per 1,000 of Total Population.	Per 1,000 of Rural Population.	Number.	Per 1,000 of Total Population.	Per 1,000 of Rural Population.
Cattle, dairy,	18,108,666	238	401	21,795,770	237	442
Cattle, other,	51,227,166	674	1,133	41,886,878	455	849
Swine,	64,686,155	851	1,431	59,473,636	647	1,205
Sheep,	61,735,014	812	1,366	52,838,748	575	1,071
In New England.						
Cattle, dairy,	893,478	160	796	841,698	128	767
Cattle, other,	713,137	128	636	494,852	76	451
Swine,	362,199	65	323	396,642	61	361
Sheep,	922,558	165	822	430,672	66	392

Giving our attention first to the country at large, it will be seen that, with the exception of dairy cattle, all other classes have not only relatively but actually decreased in the decade from 1900 to 1910, and that while dairy cattle have increased in the same period something more than three and a half million, this has been barely sufficient to keep pace with the increase in population.

The next matter to which I wish to call your attention is the relatively small numbers of all classes of domestic animals in New England as compared with the country as a whole, particularly meat-producing cattle, sheep and swine; and to the further fact that all classes, dairy cattle included, have shown a marked decrease in New England during the decade. In this connection it is of course necessary to consider the two classes of population: the consumers, most of whom dwell in the cities; the producers, or those who live in the rural districts. The United States Census divides the population of the country into urban and rural population, including in the urban population all those who dwell in cities or incorporated villages of 2,500 inhabitants or more. As you know, New England differs from the rest of the United

A herd of New England Herefords.

States in some important features of municipal organization, and has no unit comparable with the incorporated village in other parts of the country, so that the census officers, in making this distribution of the population, have classed as urban all those New England towns which contain 2,500 or more inhabitants. Many of these towns have, of course, considerable areas that are truly rural in their character, so that the rural population may perhaps be slightly decreased in New England from this cause.

In the United States, as a whole, in 1910, 53.7 per cent. of the total population were classed as rural, whereas in New England only 16.7 per cent. were so classed. This shows a much larger proportion of urban population in New England than in the country as a whole, which no doubt largely accounts for the small numbers of domestic animals in New England in proportion to the total population. I have further compared the numbers of animals in the whole country and in New England on the basis of the rural population rather than the total population, as the census reports show that the rural population per square mile in New England is practically the same as the average of the whole country, the figures being 16.6 persons per square mile in the United States as a whole, and 17 in New England. Arranging, then, the census statistics of the animal population on the basis of the rural population we find that, as compared with the country as a whole, New England had in 1900 nearly twice as many dairy cattle as the average of the whole country, and that while dairy cattle had undoubtedly increased as compared with the rural population in the whole country, they had decreased from 796 per thousand to 767 per thousand in New England, showing that even in this most important branch of animal husbandry there had been a marked decrease in the last decade. The numbers of cattle, other than dairy cattle, swine and sheep, it will be seen are markedly less, ranging from less than one-third to about one-half as many in New England as in the country as a whole, and the numbers of swine alone show a slight increase in the decade; but it will be seen that the total numbers of swine are still insignificant in New England as compared with the country as a whole.

The statistics further show clearly what is apparent to most people, — the relatively great importance of the dairy cow among the animals of the farm, particularly in New England and in the northeastern States generally.

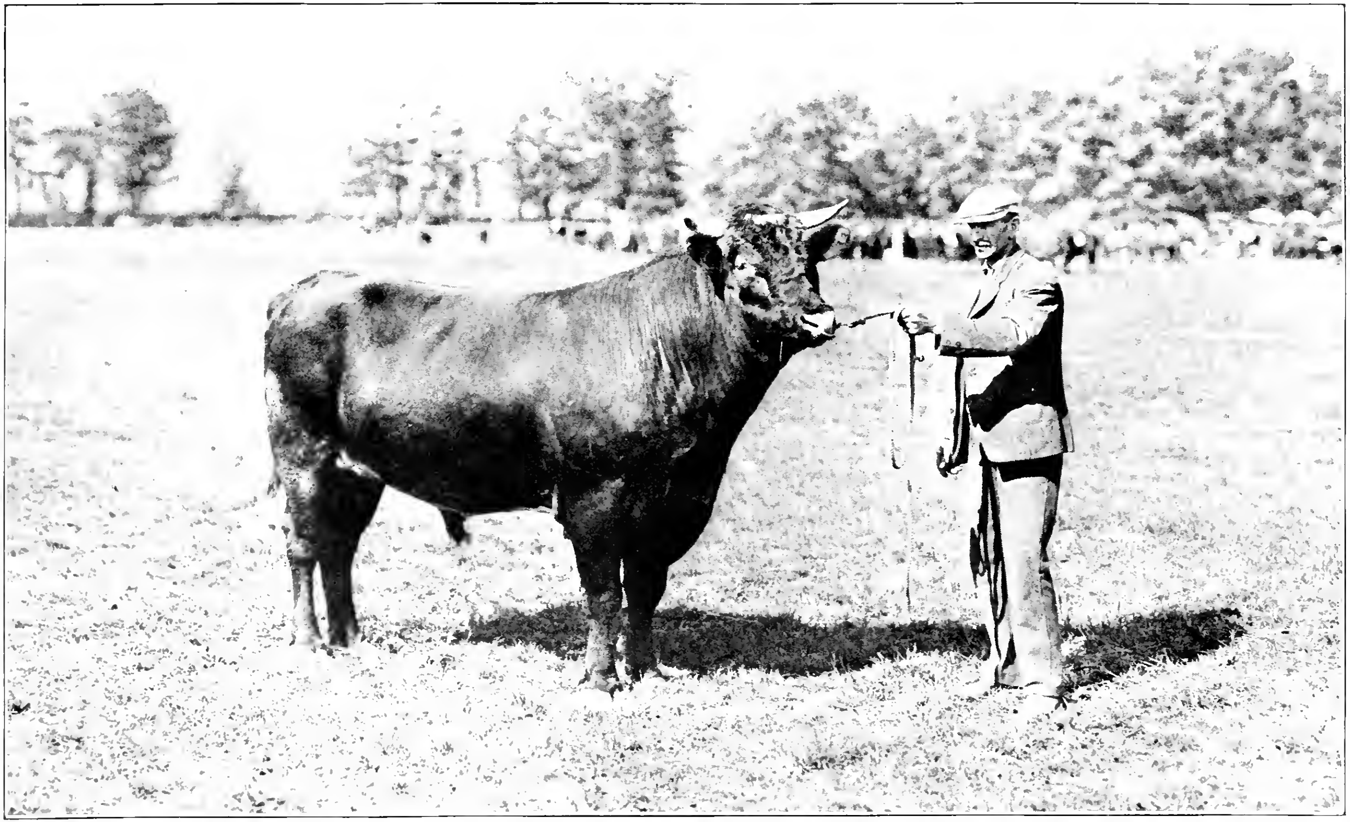
The present high price of not only beef but of all meat products, with no indication of a lessening price in the future, has brought home the question of meat consumption with great force to a large proportion of the consuming public, and the problem that confronts a great many people at the present time is the source of the meat supply in the home. Without attempting to take up the question as to whether the people in the United States eat more meat than is necessary, and the relative advantages and disadvantages of a vegetarian diet or any similar matters, I think it is safe to assume that the per capita consumption is likely to decrease, but I think that most of us, inheriting the ideas of our beef-eating English ancestors, will go a long way before we entirely forego meat as an important part of our dietary. It behooves us, then, as farmers to bestir ourselves to discover if we may not produce more meat as a profitable part of our farm industry. It is not necessary to call your attention to the fact that the conditions in the United States with regard to the production of beef have been anomalous for the last fifty years. In this time vast areas of fertile soil have been opened up for settlement and development. The crops easiest to produce on these vast areas have been grass and the cereal grains, notably corn, and the latter has been produced in abundance far beyond the capacity of the people to use as grain. A large part of this raw material has naturally gone into beef as the easiest method of marketing this crop, without regard as to whether such a practice was on the whole an economical one. We therefore became, and have remained up to the present time, a beef-exporting country, and beef has been relatively cheap. The ease of its production in the central west has put the eastern farmer entirely out of competition in the production of beef.

Two factors have been prominent in causing a decline in meat-producing animals: first, the taking up of vast areas of practically free pasturage upon which beef-producing stock could be raised; and secondly, the increased use and market for cereals, including corn, and the marked increase in the export demand for such cereals, which has relatively raised the price of the material upon which range-grown animals were fattened. During the past ten years the middle west farmer has found it less and less profitable to market his corn in the shape of beef or pork, and so the relative numbers have declined. If the consuming public continues to demand beef so that the price rises sufficiently we shall undoubtedly continue to produce it, and largely in the corn-growing regions of the middle west; but the western farmer will not in the future be as strong a competitor of the eastern farmer as he has in the past. What outlook, then, does the production of meat afford to the New England farmer under present conditions? New England will undoubtedly continue to import a large proportion of her meat supply. As the prices rise the per capita consumption will undoubtedly decrease. In either case, however, the New England farmer, constituting only about one sixth of the population, would seem to be assured of a permanent market at his own doors. The proportion of such market that he can supply will depend very largely upon his own intelligence, industry and business ability.

Along what lines, then, is it probable that profitable meat-producing farm industries may be increased? Inquiries and correspondence coming to me during the last two years have shown that there is considerable interest in the question of increased meat production in northeastern United States. This correspondence has come in considerable degree, not so much from farmers as from city people looking toward agriculture as a means of investment or employment. Nearly all such inquiries assume that if meat production is to be increased in the east it must be as a special, highly developed industry, and questions as to the proper places for specialized sheep farms, swine farms and beef farms, as distinct branches of agriculture, have been numerous.

If the meat products in New England are to be increased I see little indication that it is likely to come in this specialized form, but that it is much more likely to develop in connection with dairying, fruit growing or with other branches of agriculture; and other countries give evidence that this is likely to be so. England and Holland are two countries, both using considerable amounts of meat, both meat-importing, and both producing beef in sufficient amounts to make it an important part of the income of the rural population. The English farmer produces a few steers or a few wethers as a part of his general farm plan, and not, in most cases, as a special industry to which he devotes his whole attention; and it seems to me that if this same idea could be carried out among our New England farmers it would result in a notable increase in the meat output. The means of doing this I have not the time to discuss in very great detail, but I would like to call your attention to a few features of the matter. In the first place, I do not believe that beef production in New England is going to take the form of keeping a cow to grow a steer that shall be kept until he is two and a half years old, and then fed for ninety to one hundred and twenty days on clear corn the whole time; neither do I believe that the New England farmer is going to produce beef by crowding a calf with all the milk it can consume for six months, and then with a rich diet of heavy, concentrated food for nine months, in order to make the so-called "baby beef." Profitable beef production in the United States, and particularly in New England, must get away from the idea that unlimited consumption of highly concentrated food is necessary; and then we shall produce beef in the future, perhaps not of the superlative quality we have demanded in the past, but still of good, succulent quality, able to nourish any man, very largely from coarse forage in the form of silage and grass. Several of our western experiment stations, notably the one at Purdue University, have been working on the question of beef production through the consumption of silage. Silage has revolutionized the dairy industry in the northeastern States, and I venture to predict that it will have a similar effect on meat production. As a matter of fact, meat production for the New England farmer seems to hinge very largely on his capacity to produce more grass or more corn silage or both.

Another feature that we cannot lose sight of — and it is perhaps somewhat heretical to mention this — is the question of combining dairy and beef production. In the countries I



Dairy Shorthorn bull, Franklin County, Massachusetts. A good dual purpose type

have mentioned with similar conditions, as in New England, dairy production and meat production go hand in hand. Shorthorn cows produce a very large part of the dairy products in England. The Dutch farmer depends upon his veal calves, his surplus young cows, his bulls and an occasional steer as an important supplement to the cheese and butter that he makes from his cows. Cow beef, I am well aware, is tabooed, and perhaps, with the great attention we have given the extreme development of the dairy cow, justly so; but the matter keeps coming up with increased force as to the possibility of producing a cow that shall yield enough dairy product to give a profit to her owner, and at the same time produce a calf and carcass that will make a good amount of meat of at least fair quality. The increased interest in the so-called "Dairy Shorthorn" is only one indication of this possibility. The fact that the highest type of development of dairy and beef animals up to the present time has been in separate individuals does not, to my mind, preclude the possibility of a profitable combination of these qualities in a single animal. It is undoubtedly more difficult of accomplishment, but the fact that it is difficult should be an incentive rather than a deterrent to the enterprising New England farmer.

The question of meat supply should not be closed without some reference to the smaller animals. Chart No. 2 shows how the value of all the farm live stock increased between 1900 and 1910.

CHART NO. 2. — *Value per Head of Live Stock in United States.*

	1900.	1910.
Dairy cattle,	$29 68	$34 56
Other cattle,	21 78	24 50
Swine,	3 69	6 88
Sheep,	2 77	4 44

The history of other countries has been that as the population increases in density a larger proportion of the meat supply comes from the smaller animals. So it is likely to be in the United States. I want to call your attention to Chart No. 3, which shows that beef is the most expensive animal product to produce, and milk the cheapest — the other products ranging between these two extremes.

Chart No. 3. — *Dry Matter in Food required to produce One Pound of Edible Dry Matter in the Product.*

	Pounds.
Dairy cattle, milk,	5
Swine, pork,	8
Fowl: —	
Eggs,	14
Meat,	15
Sheep, mutton,	17
Beef cattle, beef,	23

We may come to a time when we cease to eat beef, but afterward we will still have sheep, swine and poultry to fall back upon. In the development of both sheep and swine in New England it seems to me that there is an opening for increased effort, not as a specialized industry but as a side development along with other lines of effort. New England was once pre-eminent for its sheep. While this pre-eminence may never come back, it seems to me that there are a good many localities and conditions where an increase in sheep husbandry might be attempted with profitable results. The question of the dog in regard to sheep husbandry has often been a prominent one, and is often urged as an objection, but with the modern forms of fencing, the danger from this source is greatly lessened if not entirely done away with.

Swine may be increased so as to practically supply the local markets. One important feature in the present conditions of animal husbandry in New England has undoubtedly been the absorption of the markets by the large wholesale concerns, and this will undoubtedly have to be reckoned with. Success in increased meat production in New England will undoubtedly depend upon developing small local retail markets. This may be difficult in some cases, but some personal experience has given me good illustrations of the comparative ease with which such local markets can be developed. This would seem to be a good field for co-operative effort in many cases. In very many communities the establishment of a local country market provides a very acceptable outlet for both producer and consumer.

Mr. WHEELER. I would like to ask Professor Wing if he thinks it would be advisable in this part of the country to bring in partly grown steers from the south or west and attempt to fatten them here.

Professor WING. I don't believe that it can be done at a profit if you have to depend upon purchased grain.

Mr. WHEELER. Suppose you can grow your own feed?

Professor WING. Then, so far as feed is concerned, you can get more out of it in the production of either milk or pork. If the labor is as important a factor in the cost of production as the feed is, then the decreased amount of labor in producing meat may offset the increased cost of feed, and that, as I said, is a question that will largely be determined by local conditions. I am inclined to think, however, that where you want to increase the amount of meat or beef production you will be much more likely to do it by producing your own feeding stock.

It seems to me that the question of meat supply is very closely connected with the question of the production of more grass and of more corn. The corn need not necessarily be raised for grain, because the results of experiments at the Purdue Experiment Station have shown the great value of silage in the production of beef. Now, silage revolutionized dairy practice in New York and New England. Our dairy stock probably would have gone the way of our other animals to a greater extent than they have if it had not been for the silo. Now, it is entirely possible that the use of the silo may help us to partially revolutionize the beef production, or may be a great aid in the increased production of beef in the northeastern United States. If you can raise more corn and more grass on your farms you can grow more cattle, and, as they used to say in New York about pigs, you will have more manure to make your crops grow, until you have filled up these New England valleys completely with corn and cattle and grass.

Mr. WHEELER. Don't you think that our problem here in restoring the utility of our lands is in raising more animals, and don't you think that our land is more adapted, in a sense, to raising beef animals than dairy animals?

Professor WING. No, I would not give up the dairy cow in any part of northeastern United States. You can't make digestible human food any more economically from any domestic animal than you can from the dairy cow. Now, if the labor bill does not get so high as to preclude dairying, she is going to be the predominant animal in all of this thickly settled country. If we do produce more beef, all the indications that I can discover point to the fact that increase in meat production will only be a supplement to dairy production. I don't believe you are going to keep less cows, but you are going to keep, perhaps, more beef animals. I don't believe that dairying is going to be a less important part of your industries is, perhaps, a better way to put it.

Mr. RUSSELL. Do I understand that you are advocating the dual-purpose cow?

Professor WING. Yes, I am advocating the dual-purpose cow. That is heresy. I may be drawn and quartered for doing it, but the time has passed when we can keep a cow in the west solely for her calf, and the time has passed in the east when we can keep a cow and totally ignore the value of her carcass, or her son's carcass.

Mr. RUSSELL. That is, you believe that milk at 4 cents a quart is better sold than fed to a calf for beef?

Professor WING. Probably, yes.

Mr. WHEELER. I don't think Professor Wing quite understood my idea; that is, not to do away with dairy cows at all, but to utilize an enormous amount of land in the hill towns of Massachusetts where the transportation problem practically makes dairying impossible. Don't you think it is more profitable to keep beef animals in those sections than it is to attempt to do dairying in those sections?

Professor WING. Very likely. But that will mean, in the first place, that those areas will have to be better farmed than they are now; that is to say, we have got to stimulate the growth of grass. At first in these hill towns on this rough pasturage you should try sheep, and very likely you would find after the sheep had cleaned these areas up the grasses would come in, the land would get a little more fertility, and then it would support beef. But it seems to me there is

Dairy Shorthorn cattle, Franklin County, Massachusetts.

abundant opportunity for development along that line. It is, however, going to be done slowly. You are going to do it first on farms where you have some tillable areas; where you can produce silage and hay and use your upland pastures. Grass grows native in New England; if you will give it a chance it will come in. It only requires a little additional fertility. I believe, too, that one reason for the present condition is that same factor of competition that we had in the west. When this strong competition in beef production came from the west we let those things go. Now the question is, whether the time has not come when we can diversify our industries and gradually work into a better development and better utilization of these areas.

Mr. WHEELER. What do you think of our lowland? Here in Massachusetts we have some 500,000 acres of lowlands, at the present time practically untillable, too wet to cultivate, yet growing big crops of grass and cheap hay, which of course now is used largely for bedding purposes. I don't mean salt marshes but fresh marshes. Are those practical to use, a part of the year at least, for beef animals?

Professor WING. Oh, yes. Just as soon as it will pay you to drain them. All of this waste land is to be drained and utilized eventually; the question is, how soon and in what way. The answer to that question will depend upon the cost of drainage. There you are going to produce just exactly the material to make a cheap meat.

Mr. WHEELER. I mean, before they are drained, — in their present condition?

Professor WING. I am afraid not. Those sedges and other coarse foods of that sort you can't utilize very much more for beef than for any other purpose.

QUESTION. I believe there is one phase that has not been brought out. I don't know how it is in New York State, but around here, for a good-sized calf that weighs from 80 to 100 pounds, they will give about $5 when born. Within two years I have known of a calf being sold in Spencer for $22.50 when it was only eight weeks old. Now, the temptation is for the farmer to take his $5 for the young calf, or $15 to $25 for the ordinary calf for veal, rather than to keep it until it is a year old and sell it for the same money. As far as the steers are concerned, you can turn off a heifer when she is two years old, fattened on grass, but the steer must be kept until he is past three years. I overheard a neighbor here say that he had a yoke of oxen that would weigh 3,400 pounds, and he could get $300 for them to-day. I wish you would say a little more about this calf raising and what it costs.

Professor WING. The point that the gentleman has brought out is a very good one, and I can match his story with regard to veal, I think, in New York State. One of our neighbors took two calves to market, less than eight weeks old, early last spring — I think in February or March — and brought home a little over $60 for the two. Now, that is the way for bull calves to go, and it is the way for the heifer calf to go, as many as you can spare, but you must bear in mind that you have got to keep up the population some way, and you probably will have to raise some heifer calves. We have made a fairly careful study of raising heifers for several years. It costs us about $15 to raise a heifer calf to five or six months of age. Then we have to pasture her up to two years of age before she comes into production. Now, in regard to the producing cow. The cow will pay for herself, if she is worth raising at all, after she is two years old. You get a profit from her — should begin to get a profit from her — as soon as she is four years old by the milk she produces. If you keep her until she is eight years old she begins then to take on flesh rapidly. Then is the time to get rid of her. Then what you get for that cow will bring up the heifer calf until she is two years old. So if the heifer calf was worth $30 when it was eight weeks old for beef, why we have got to carry her along, — a certain percentage of them, — enough to keep us going, because we have got to make that investment. But we should have a cow so good, like one of the dairy Shorthorns, that she will be worth for beef, at eight years old, enough to pay for replacing her with a two-year-old heifer in your herd, and that two-year-old heifer should again be better than her dam was.

Mr. BARNARD. Can't the pastures back on our hills be brought up and improved faster under this method of keeping the dual-purpose animal and raising a few calves every year.

— can't we improve those pastures much faster than we would by simply keeping cows, and buying our cows on the market and letting them go, just keeping them in the pasture during the day and in the barn at night?

Professor WING. It seems to me that that is a question that can't be answered categorically yes or no. It is for each man to discover. That is your business, — to study your own conditions as to whether you can do as you indicate. Now, I think that there are very many localities in which that very thing can be done. Raise more animals than you are raising; utilize your rougher land, bearing in mind all the while that you have got to put something into that land and so build it up; and keep a large drove of animals other than strictly dairy cows. But it may or may not be so, according to individual circumstances. That is what the Englishman is doing; that is what the Hollander is doing to some extent, — not so much, perhaps, as the Englishman. I would like to say one word further in regard to the question you raise in regard to the dual-purpose animal, and put myself, perhaps, in a little better light. I don't believe that a dual-purpose animal will compete in quality or economical production of beef with a special-purpose beef-producing breed. I don't believe that a dual-purpose animal will compete with a well-bred dairy cow for the sole production of milk or milk products; but I do think there is abundant room for an animal to be produced that will produce profitably both milk and beef.

I don't believe, take it as it runs, New England soil is any less productive, or has any less capacity, than it had when the pilgrims landed on Plymouth Rock, and I think that the time is coming back when New England farmers are more and more going to be as their ancestors were, — self-contained, self-reliant, and are going to produce more of their food products. They are going to diversify their industries. It is a diversified country. It lends itself to diversified production, — some mutton, some beef, some pork, some chickens, lots of fruits and plenty of vegetables.

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PROFITABLE FARM POULTRY WITH SPECIAL REFERENCE TO EGGS AND MEAT.

BY W. R. GRAHAM.

FROM THE SIXTY-SECOND ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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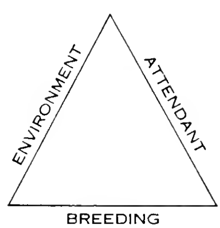
PROFITABLE FARM POULTRY WITH SPECIAL REFERENCE TO EGGS AND MEAT.

W. R. GRAHAM, PROFESSOR OF POULTRY HUSBANDRY, ONTARIO AGRICULTURAL COLLEGE, GUELPH, ONTARIO, CANADA.

Farmers in practically all countries of the world find the keeping of poultry profitable. It is true that some make much more money than others, which is also true of almost any branch of agriculture. Speaking generally, farmers grow better poultry than do those who try to grow a large number of chickens on a small area. My observations have been that most people succeed best, taking one year with another, who grow a variety of crops, rather than those who grow but one crop.

Let us now try and analyse the keeping of poultry on the farm. Permit me to present a diagram so that we may clearly understand our position.



We have here presented a triangle, all sides of which are equal, and my experience and observation leads me to believe that in order to succeed well it is necessary that equal attention be paid to each side, and, furthermore, neglect of any of these factors may be the primary cause of partial or complete failure.

The base or foundation represents breeding. Good blood is of prime importance. We all realize the importance of good breeding and constant selection in cattle, seeds, fruit trees, etc. Few, if any, expect heavy milk production or beef production from scrub cattle. Poor seed means a poor crop, and the planting of fruit trees of unknown varieties or seedling stock is not good business. The same is true of poultry just as much as in any other branch of farming. Good stock is the foundation. No matter how well fed and housed, nor how faithful and careful the attendant may be, the best success is not obtained without foundation stock of good breeding.

Study the kind of product your market demands, and then breed to please the buyer. I take it that you have here a good market for both meat and eggs. This means a discussion of the breeding of the dual-purpose hen, or what may be termed the American breeds in general. No doubt some of you may breed especially for egg production, and others breed largely for flesh production. The same general ideas, I think, will apply in all cases.

A study of European markets, and to some extent home markets, indicates that in the production of a high-class article *uniformity* is of prime importance. The *uniformity* of the goods shipped by Denmark makes a market for Danish produce. A farmer who has a reputation of producing a uniform good class of produce, whose produce is dependable, has less difficulty in selling, and ordinarily gets a premium price. He produces a uniform, dependable article. Uniformity in dressed poultry is not secured from scrub stock, and at times not from pure-bred stock; the same, in a measure, applies to size and color of eggs. In order to produce a uniform product it is necessary to study some of the underlying principles of breeding. With your permission I wish to show illustrations of some of the things that happen in breeding, also to discuss for a few moments some common practices in breeding. I am not a biologist, but I am interested in practical breeding, and therefore study as a common layman, and endeavor to try out in a practical way what science tells us. The art of poultry breeding is science applied. The first thing to do is to select pure-bred birds of the type or shape desired. If these cannot be found it may, in special instances, be desirable to cross breeds. In selecting breeding birds constitution or vigor is of first importance; it is the mainspring of the works, so to speak. Then we may select as to shape, size, egg production, color of skin and plumage, and if possible hatching power of eggs. Some of these characters are visible, others are masked or hidden, and the birds must be tried out. Select those that breed the best birds, regardless of relationship. Some say inbreed, others say do not inbreed. What is one to do? After trap-nesting and pedigreeing poultry for over ten years, and coupling with this some years of observation in breeding with small and large matings, I now am at the point where I would answer the above question by saying it depends upon circumstances.

Let us examine some of these ideas. Take, for example, the characteristic of size. If we cross a small breed with a large breed the resulting offspring in the first generation will be intermediate in size between the two, and are usually fairly, if not exceptionally, uniform in size. These crossbreeds may please us to such an extent that we decide to breed them together and perpetuate the kind; but here we encounter a difficulty, for in the second generation, or perhaps the third, if we rear, say, five hundred specimens, we find we have no uniformity either in weight, size, shape or anything else. We have about every conceivable thing that is known in chickendom, and, moreover, the mortality in birds bred as above is usually very high. We have lost that valuable desideratum — uniformity, though we may still have a few individuals of exceptional merit. This is the method to follow where you wish to secure something that you cannot already find in the existing breeds. As a common practice it is bad policy. Such results are probably the cause of the idea "do not inbreed." A similar result has come under my observation where two absolutely distinct lines of the same breed have been crossed and the progeny of such a mating bred together.

Now let us look at another side of this same method of breeding. If we take the few specimens that meet our ideal, and have plenty of constitution, and breed them together we find we begin to produce a uniform flock of a new kind. True, many may have to be discarded, but by close breeding we tend to fix the characteristics.

This does not yet answer the question as to what would be a good practice for the farmer.

The common practice of buying a new pure-bred male from a different breeder each season, where some care is taken as to general vigor and type, will generally give fairly good results as far as visible characteristics are concerned, because one is practically producing in a more or less degree the first cross. This plan must, in most instances, be continued.

Where one desires to make a product quite distinctive it will usually best be done by inbreeding the crossbred strains, watching for the divisions, selecting the individuals which meet the ideal and then inbreeding these.

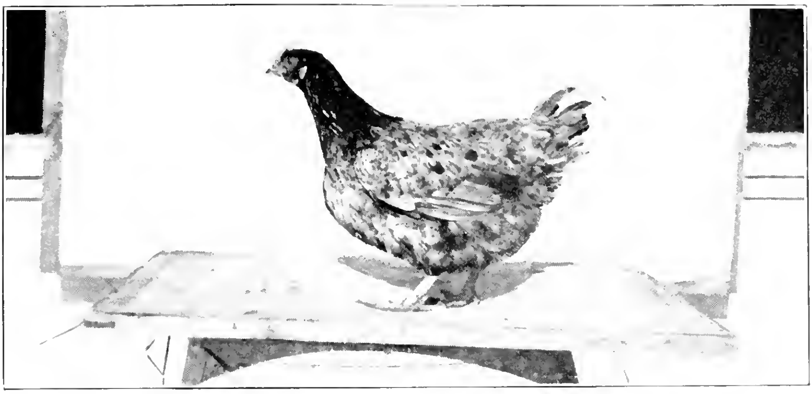
The perfect specimen probably does not exist, hence, ordinarily speaking, one is forced occasionally to introduce new blood. This is best done by means of a new female, and then trying the offspring sparingly until such times as you get what you want.

Our pedigrees indicate that the male has much more to do with the pullets laying than does the female. It is, therefore, obvious that we should buy and select males from good laying hens that have been mated to good males, and I would consider it worthy of a trial to buy the new males annually from some *one* reliable breeder year after year so long as the resulting offspring is satisfactory.

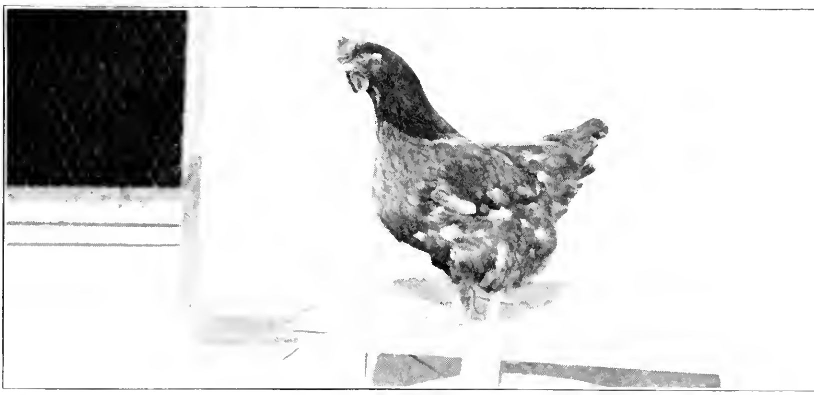
Where eggs are wanted, especially during the first year of the hen's life, it is of importance to select birds, particularly males, which mature to nearly the desired weight at about five or six months. Closely associated with this, in our experience, is the question of early feathering over the back. Slow back feathering generally means slow maturing, which in turn is late laying. Our best layers usually begin laying at five, six or seven months of age.

The next side of the triangle refers to environment; that is, age of stock, housing, feeding and range. These conditions must be first class.

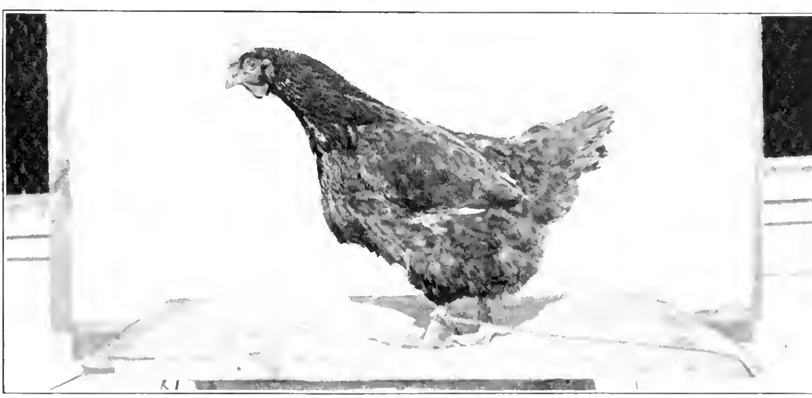
Late-hatched pullets seldom mature early enough to lay during the period of the high prices of eggs, neither do yearling hens commonly lay as well during the period of high prices as early hatched pullets, and hens two years old and over pay only as special breeders. Our records show, yearly, that birds that lay well during the winter are equally as good layers for the



No. 400. Laid 208 eggs in ten months.



No. 523. Laid 50 eggs in twelve months.



No. 312. Laid 194 eggs in nine months and three days.

THREE HENS FROM THE MASSACHUSETTS AGRICULTURAL COLLEGE FLOCK.

balance of the year as those who make little or no performance during the winter months.

Sizes, shapes and styles of houses are almost endless. This problem is ever present, and each one settles it to please his or her own conditions. It matters not so much the kind of house so long as abundance of fresh air is secured without direct drafts over the birds, and as long as the house is light and roomy. Dryness and reasonable cleanliness are also prime factors. The smaller the flock the larger proportionately should be the house, and, moreover, the labor cost per hen for caring for her is also increased. A man will take care of 15 one-hundred-bird flocks with less exertion than 70 ten-bird flocks. Your labor charges for care and management should be about 35 or 40 cents per hen per year. Keep your poultry houses well aired, dry and clean.

Feeds and methods of feeding are countless. Common sense appears to be an inactive factor in many human beings. Some try to mix and feed the most complicated grain mixtures possible. All these things take time and time costs money. I am not at all sure that a hard and fast rule for feeding can be laid down. The essentials can be enumerated and are as follows: green food, grain food, animal food, mineral food and exercise.

Green food ordinarily is cheap and handy, receives little attention, and hence I place it first to draw your attention. Poultry require considerable green food; it reduces the expensive feed bills and sustains health. In summer various grasses and waste garden truck supply the wants. Little chicks require very tender, crisp, green feed. For winter foods, clover, hay, roots, cabbage or sprouted oats will give good results. Feeding cooked roots is also a good means of cheapening the ration.

Experimental demonstrations with us show no great difference among these foods. Cabbage, if anything, encourages laying, while rape tends to color the yolks of eggs in some instances seriously, from a market standpoint. A full-grown hen will eat about 1½ cubic inches of sprouted oats per day. Ordinarily give the birds all they want, but do not feed decomposed or highly flavored feeds.

Wheat, corn and crushed oats are the staple grain feeds, and for animal foods nothing equals sour milk or buttermilk; when meat scrap has to be fed, about 10 per cent. of the mash food is all that may be given with safety. The birds would eat more and might do better for a short period of time, but a reaction is almost sure to follow. Mineral foods are supplied by granulated bone, granulated rock or grit, and oyster shell or old plaster.

It might be well to give you our method of feeding and then we might discuss the same. During the winter we use about equal parts of whole wheat and corn. This is fed in about 6 inches of litter early in the morning, say two handfuls for three birds. At noon the green food is given, and at night all the whole grain they will eat. We keep crushed oats in hoppers constantly before the birds. If the flocks gets lazy we close the hopper for part of the day to make them work. Sour milk is used as drink. Grit, oyster shell and granulated bone are always in little boxes where they can help themselves. When we cannot get sour milk and have to feed beef scrap I rather prefer mixing ground grain, such as middlings, corn meal, oat chop and 10 per cent meat meal, then feeding as a moist mash at midday. Sometimes we add to such a mixture about one-third in bulk of cooked roots.

The environmental factor of range is overlooked so frequently that I desire to call special attention to it. The following illustrations are two birds of the same breeding. The larger one is grown on free range where there are not more than fifty chickens per acre, and the smaller one in a small city lot where chickens are penned up. The case is extreme, yet at the same time is not uncommon.

Clean ground, tender green food, clean water and shade are essentials to growing chickens. Ground may be cleaned by crop rotation, which is undoubtedly the best plan, or it may be kept in fair condition by frequent plowing or digging. The proposition can be put in another form; that is, raise the young stock in the country, where there is an abundance of room and a variety of food, then you may bring them, when well grown, to the city, or the permanent long houses with limited runs. Old fowls can be maintained fairly well on old ground, but young stock rarely does well. This is the outstanding point in the farmer's case. He raises better chickens at less cost, owing to clean and pure surroundings.

Let us now consider the remaining side of the triangle. The attendant is worthy of serious consideration. My father told me that "one man's breath was good for stock and other men's breath was bad." This appears in a sense to be true. The attendant must develop a bond of sympathy between the birds and himself; in order to do a day's work he must move rather quickly but gently. Birds that are afraid of the attendant do not do their best. The attendant must consider his stock first and foremost and himself last. I believe in having a man dressed neatly but plainly. A poultry house is no place for blue clothes and white collars. A khaki suit shows little dirt and looks fairly neat. The attendant must be a keen observer, punctual as to hours, and have an abundance of common sense. Caring for live stock is no position for the careless, or the person who is looking for 6 o'clock.

In conclusion I would suggest the attendant keeping in his hat the following words: "Fresh air and common sense." If these are there and he removes his hat occasionally he will not forget.

Mr. N. W. Sanborn. How about the weight of these high-laying females? Do you get as many pounds of eggs from the large egg-layers as from the moderate sized ones?

Professor Graham. Generally speaking, you will find more 200-egg hens which lay 23-ounce eggs than lay 25-ounce eggs to the dozen. We constantly have hens which will lay large eggs, — many of them. One of the hens we showed on the screen — No. 58 — laid 25-ounce eggs; but I will say that if you don't watch it you will produce little eggs.

Mr. W. H. Gould. Which do you consider the best flooring for a hen house, especially in the winter season, — earth or cement?

Professor Graham. Well, my experience in regard to the best flooring for hen houses is this: when you consider the cost of the litter and the cost of taking the ground out of the hen house every other year and renewing it, cement is the best floor. It takes more litter on a ground floor, and in a series of years, if you figure up the time and the cost of renewing the earth floor, it is better to have the cement floor. Now, where you use the cement floor, ordinarily you must supply some sort of a dust bag in one corner of the house. If you use only a little litter — say, two or three inches — then in a cold climate you get into trouble with the cement floor. In addition to that, never make the cement floor smooth or very rough. If you make it smooth the litter will blow all round the place; if you make it very rough the hens will wear their toenails down to the quick. The common finish, such as you have on sidewalks, is about the best that we know of. We have taken out practically all of our board floors and all our ground floors and are using almost entirely cement floors.

Mr. Thomas D. Govern. Can you get as many eggs by feeding hard grain and dry mash as by feeding wet mash?

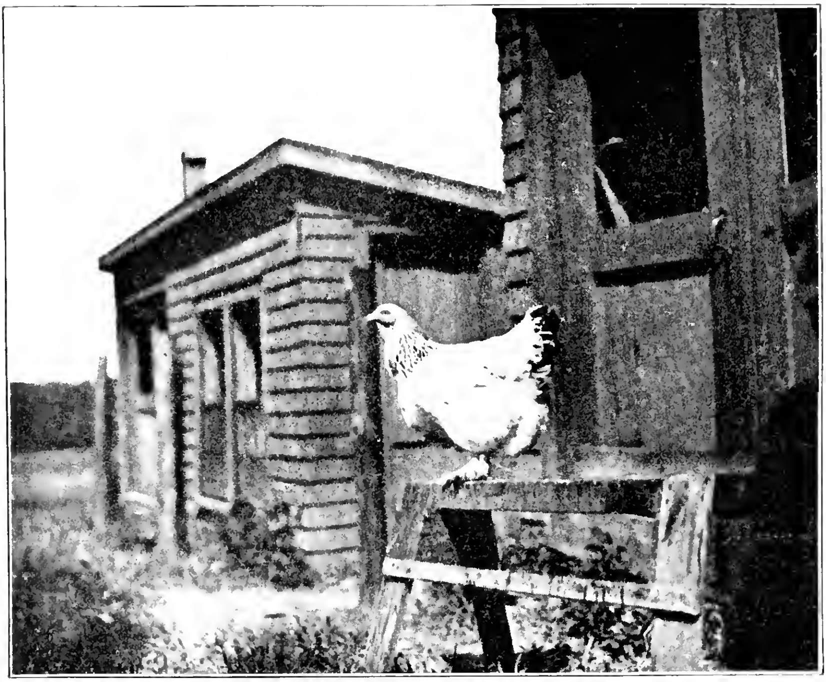
Professor Graham. Where we use rolled oats we can, but I doubt it with other mixtures. The backbone of our egg production, in a word, depends on the rolled oats and the sour milk and the green food.

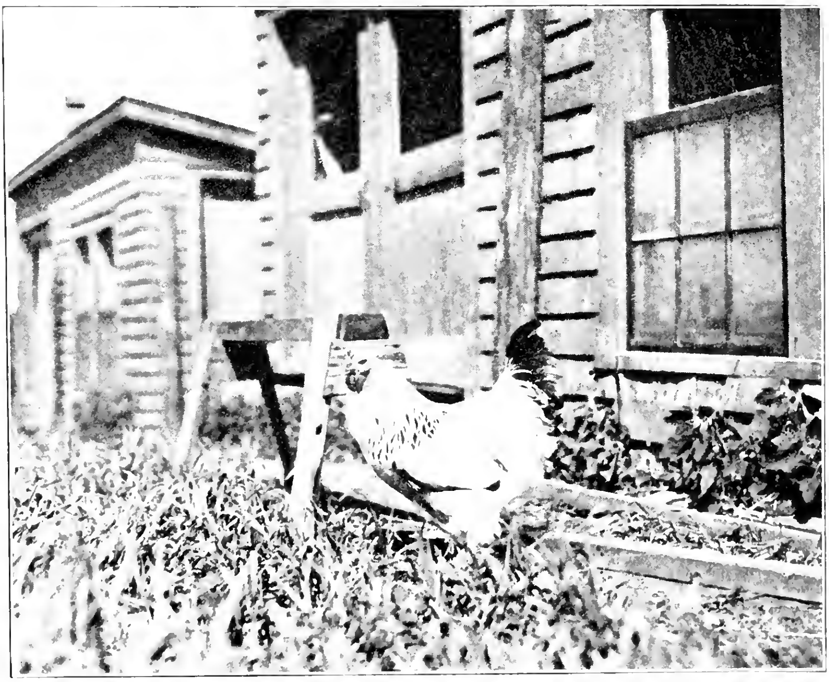
Mr. Govern. In Massachusetts, with milk at 42 cents a can, we can't very well afford to feed it to hens.

Professor Graham. That is true. There is a difference in different sections of the country. With us sour milk is worth 20 cents a hundred. That is not very high. We buy oats at $28 a ton, $1.40 a hundred. But we can't get as many eggs out of beef scrap or cooked meat as we can out of sour milk. If you want to use beef scrap I would strongly advise your using a little bit of muriatic acid in the drinking water, for the reason that the hen's digestive tract is normally acid, and we frequently get into trouble when their digestive tracts become alkaline, and with sour milk, too, you get a value beyond the feeding value of the milk, largely due to its physical action, which maintains the normal sour or acid digestive tract. It has a value greater than its chemical composition shows.

Mr. C. F. Whitman. You dwelt considerably on feeding vegetables to poultry. Would you recommend feeding fruit, — apples or pears?

Professor Graham. Yes. I would recommend the feeding of apples.





A pair of good utility fowls. Massachusetts Agricultural College.

Mr. Whitman. Do you think it is good to feed vegetables?

Professor Graham. As long as they do not eat too many of the seeds, which is ordinarily not the case. At the present time we are mixing them in with roots. I would say in a general way that it is a good plan to give the hens any waste products that you have, like apples or turnips, but do not feed them on waste products exclusively.

Mr. Whitman. I asked that question because I want to know whether the cider pulp is better, or the apples and fruit itself before extraction.

Professor Graham. I will have to go back a number of years to give you my experience on cider pulp. During my first experiences in the chicken business I happened to be situated near a cider mill, and was able to secure cider pulp from the mill at low rate; and when I got that pulp fresh, when it had been ground the same day, and when I cooked it a little I got good results; but if I kept it on hand and it heated or turned a little sour the results were disastrous. Judging from this experience it would be necessary to feed it fresh.

Mr. J. M. Schwartz. In mentioning your green feed you don't say anything about alfalfa. How does that compare with cabbages?

Professor Graham. I have good results from good alfalfa, but in many instances with the alfalfa that we come in contact with, apparently they have taken the leaves off and used them for some other purpose. They sold us the woody stems as chicken feed, which has not given very good results. If you can get good alfalfa you will get very good results indeed. Personally, I would just as soon have the roots as I would alfalfa.

Mr. G. S. Dodge. How about feeding green ground bone?

Professor Graham. That depends on the kind of bone. If you are grinding the bones yourself by hand, I would say do not feed it, because you will get all of the knuckle bones which contain a very high percentage of fat, and are easy to cut. We have found in our experience that the machine-ground green cut bone, if fed with good judgment, will give good results. Where it is fed fairly liberally to the heavy breeds, such as

Plymouth Rocks or Wyandottes, it is apt to have some effect upon the hatching power of the eggs in the spring, and it is a food that has to be fed with discretion. I would say, in a nutshell, it is a good food for a man with an abundance of common sense to use, but it is a bad food if considered fool-proof.

QUESTION. Is there any easy way to sour milk in the winter time?

Professor GRAHAM. Yes, a very easy way is to put the sweet milk in a pail that has had sour milk in it and set it behind the kitchen stove over night and it will be sour before morning. One of the finest things about feeding sour milk is that you don't have to worry about everything being absolutely clean. If you are feeding sweet milk you must have everything clean. The easy way to get it sour is to use a barrel or large hogshead that holds from 30 to 100 gallons, and keep on pouring in and out.

QUESTION. Do you feed the sour milk clear?

Professor GRAHAM. Yes. As far as drink is concerned, when the thermometer goes below zero, all drinks are taken away and the chickens all eat snow. You will have less trouble with frozen combs and things of that kind if you feed snow.

QUESTION. You do not think snow brings bowel complaint in any form whatever?

Professor GRAHAM. No, I have never had that experience with it at all. We let them wallow around in the snow and eat it in cold weather. We dump the water out of the drinking tins and keep them filled with snow.

Mr. C. R. HARRIS. You mentioned the use of hydrochloric acid in the drinking water. Would anything else answer the same purpose?

Professor GRAHAM. I am not in a position to answer that question. I have gotten my information along this line from our veterinary general of the dominion, and I asked him one day, "Is there any other acid that I could use or recommend in the place of this one?" He answered, "That is the only one that I have positive information on." So that is the best answer I can give you.

Mr. HARRIS. Is there anything other than judgment by which you can determine the amount and frequency of the use of hydrochloric acid?

Professor GRAHAM. From the available experience, for the quantity for general preventive work, about 1 teaspoonful of commercial acid to 2 gallons of drinking water. Either earthenware or wooden drinking articles should be used. You could not use the acid and metal very long or you would be in trouble.

Mr. BROWN. Would a flock of hens get sufficient drink through the winter from snow alone?

Professor GRAHAM. From our experience, yes, because we have numerous flocks of hens that are laying heavily in the winter time that don't get anything to drink except snow for weeks at a time. They may get some cooked vegetables or substances containing water, but, for example, in this open-front house I showed you we sometimes have a week at a stretch when the thermometer is between 10 and 29 below zero, and the thermometer inside the house showing from zero to 7 below. Now, you take an ordinary pail of water and set it down there and it is ice before you get out, almost. So there are weeks and weeks when they don't get anything but snow.

Professor BROOKS. I would like to ask the speaker whether he has ever had any complaints of the quality of eggs from feeding cabbages.

Professor GRAHAM. We have gone fairly thoroughly into the matter, and even from a high-class retail trade in eggs we have never had any complaints as to flavor, even when the hens had all the cabbages they could eat. I cannot say the same when the hens were fed rape, scorched or musty grains or onions, however, for these almost always affected the flavor unfavorably, and our customers noticed it.

Professor BROOKS. I don't want to occupy the time that belongs to the speaker, but I do wish to say that a number of years ago I compared two flocks of hens of similar breeding and similar housing in every respect, and fed similarly except as regards vegetable food. The eggs from the two lots were sent under numbers to a number of families, and the housekeepers were discriminating. There was never any failure to indicate that the eggs from the hens which were fed with the cabbage were superior to the others. They spoke of their sweetness and fine flavor; they did not recognize the cabbage.

They did not know what the feeding was. The two lots of eggs were simply sent with the request that they use them and advise if they found them different. There was always a report favorable to the cabbage. As to the analysis, they did not show a great difference but there was no taint in the eggs from the fowl fed with cabbages. Many of the housekeepers reported that they found that the flavor of the cabbage eggs was strong. They did not describe the cabbage flavor.

Professor GRAHAM. I think what Professor Brooks says is absolutely correct. Now, I don't know whether you have in your locality here a trade for certified eggs such as there is for certified milk. I am under the impression that if that trade ever develops, the hens who lay those eggs will have to be kept indoors all the time. You will have to feed them right up on a diet arranged by a practical dietician, because there is no doubt that people who are not living an active life are mighty particular about the flavor of the eggs and the color of the yolk.

Mr. H. K. PROCTOR. I would like to ask about the fertility of hatching eggs.

Professor GRAHAM. Do you mean fertility or hatching power?

Mr. PROCTOR. Well, hatching power. Which would be better, to put, say, four or five males with a flock, or alternate them one each day for five days and then repeat?

Professor GRAHAM. I think from my experience the answer to that question would depend upon the range and the style of house in use. That is to say, if you had 5 males in the flock and 100 females there, or 75, and a house 20 feet square and the birds fastened inside, you would get better results to use the males a half day each, one in the morning and one in the afternoon, or one a day. But if the birds can get outside, or if the birds are in a long house in which there are partitions going three-quarters of the way across, then I doubt very much whether you would get actual results for the labor of cooping these males.

Mr. PROCTOR. Once in a while there is a cockerel who will give his head a little shake. He seems to be vigorous and all right in every way. I would like to know if that is a bad habit.

Professor GRAHAM. Well, I don't know, Mr. Proctor, whether that is a habit. It is sometimes one of the symptoms of worms. You could find out easily by going to your druggist and getting a worm powder, or take a piece of bread and put on turpentine and put it down his throat, or give him a chew of tobacco.

Professor BROOKS. About the rolled oats. Are those the oats from which the hulls have been separated?

Professor GRAHAM. The commonest kind of horse feed with us is the rolled or crushed oats, in which the whole oat is run through a roller and the oat comes out flat. Now, the men who handle horses in the largest number are farmers, and the farmers swear by rolled oats for horses. The way we started to feed them to the hens was, when ordering ground oats from a miller, he said he hadn't any on hand, but he sent us some rolled oats. The hens took so kindly to the proposition and liked it so much better than they did the chopped oats that I was perfectly satisfied. Now, they don't eat all the hull. As near as we can tell, they waste about 18 per cent of the hull.

Professor BROOKS. Would you blame them for wasting 100 per cent of the hull?

Professor GRAHAM. Yes, for this reason, which brings up a very interesting point: it seems to me that there are two sides to a feeding proposition, — a physiological side and a commercial side, and a certain amount of bran or alfalfa may obviate trouble in the stomach and give the juices of the stomach a better chance to act. We have tried the ordinary oats alongside of the common horse oats or crushed oats, and invariably we have gotten for a long period of time better results from the horse kind of oats than we did from the human kind of oats; but for a short period of time, say ten days or two weeks, if you want to fatten a chicken or get him ready for show, you can get there quicker with the aid of flour or rolled oats which you have for human food than you can with the crushed oats as fed to horses. But in the end we lose out in that we run into digestive troubles, particularly in the liver, we get a soft, pink liver. The average hen with us eats 72 pounds per year, — 24 pounds of corn, 24 pounds of wheat and 24 pounds of crushed oats.

QUESTION. What do you consider the best feed for fattening chickens?

Professor GRAHAM. Ours is a milk-feeding proposition. We teach our people to eat milk-fed chickens, and those are the chickens that bring highest prices. We use about two parts of finely ground oats or flour, or oats with the hulls partly sifted out, two parts of buckwheat and one of corn meal, mixed with sour milk. The vital factor is sour milk.

Mr. ROBERT JOHNSON. How about barley for feeding?

Professor GRAHAM. It depends entirely upon the barley. If your barley is well ripened and is not musty I would be inclined to feed about two-thirds barley, but I would want to be absolutely certain that that barley was not musty and had not been scoured before I used it, because it is one of the grains about which it is difficult to tell whether it has been a little bit musty or not.

Mr. HIGGINSON. How often do you feed cooked food?

Professor GRAHAM. I don't suppose, ordinarily speaking, that we fed cooked feed twice a year, except from an experimental standpoint, until this year. Now we are feeding more cooked food than we ever did before, because grain is high and we have a host of mangels. It is a question of getting the mangels out of the way and cutting down the grain bill. But ordinarily we do not cook any feed. We sprout oats for them, or we give them cabbage and go ahead without any cooked feed. Just at the present moment labor is cheaper than feed. Ordinarily labor is dearer than feed, and when labor is dear and feed is cheap we will feed the feed and do away with the labor.

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HOUSEHOLD ACCOUNTING.

By Miss LAURA COMSTOCK.

From the Sixty-second Annual Report of the Massachusetts State Board of Agriculture.

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HOUSEHOLD ACCOUNTING.

MISS LAURA COMSTOCK, EXTENSION PROFESSOR OF HOME ECONOMICS, MASSACHUSETTS AGRICULTURAL COLLEGE, AMHERST, MASSACHUSETTS.

Mrs. Lucas[1] has said that "in olden times women thought and thought and thought before they spent, — now women often spend and then think and think and think." If this is true, how may a change be brought about? By convincing the homemakers of their responsibility with regard to the expenditure of funds; by showing them that homemaking has in it all the elemental features of a true business, and that to succeed in it requires the best of training.

Contrast the present-day housekeeping with that of fifty years ago. Have the keepers of the home made as great an advance in their business as the farmer, for instance, has in his? If not, how may this be remedied?

Organizing ability is one of the requisites. The routine of housework in the least time and with the least energy can be accomplished only after much study, but that is not all; the responsibility of spending much of the income also rests upon the housewife. This is one of her greatest problems. To succeed she must view the question in all of its phases before spending a dollar. In other words, a budget should be made and lived up to as nearly as possible.

When a home is started there should be the utmost frankness in the discussion of the standards to be maintained in that home. It is taken for granted that there will be certain ideals. These ideals will undoubtedly change from year to year, — grow higher as the lives of the homemakers enlarge. These changes will affect the way in which the income is spent. More money will be devoted to one purpose and less to another. Certain standards will be felt to be absolutely necessary to the home life. True co-operation must exist from the first, so that no differences may later arise to shatter these ideals. When both husband and wife fully realize what they wish to express

[1] Lucas, Bertha J. R., "The Woman who spends," p. 12.

by their home, and know the yearly amount of money at their disposal, then let them discuss how to spend that income to the best advantage. To have clearly in mind what each particular purchase will give to the home, to know that it supplies a real need, will bring true contentment. It will satisfy not only the individual but the group which constitutes the family. The right idea of use will prevent worthless buying. How may this be accomplished? Not only by making a budget but by keeping a strict account of all expenditures. Mrs. Richards has said that "the great educational value of knowing how our money is spent cannot be overestimated."

Budgets.

First, then, the budget must be considered. If a home is just being established, then recourse must be had to the budgets of families living in similar circumstances. If it be a family of some years' standing, and no accounts have been kept, the budgets of other groups must be consulted; but in addition some help may be given by an estimate of the outgo of previous years.

In dividing the income the ideals of the family will modify the amounts suggested for each column. In the budgets considered the average American family will be taken as the unit, two adults and three children under working age, or the equivalent of four adults.

Suggested Budgets. [1]

Family Income.	Percentage for —				
	Food.	Rent.	Operating Expenses (Wages, Fuel, Light, etc.).	Clothes.	Higher Life (Books, Travel, Church, Charity, Savings, Insurance).
Two adults and two or three children (equal to four adults):					
Any income (ideal division), . .	25	20±	15±	15±	25
$2,000 to $4,000, ...	25	20±	15±	20±	20
$800 to $1,000, ...	30	20	10	15	25
$500 to $800, ...	45	15	10	10	20
Under $500, ...	60	15	5	10	10

[1] Richards, Ellen H., "The Cost of Living," 1905, published by J. Wiley & Sons.

In the "ideal division" it will be noted that 25 per cent is spent for food; 20 per cent plus or minus for rent; 15 per cent plus or minus for operating expenses; 15 per cent plus or minus for clothes; and 25 per cent for the higher life.

Food.

There are five divisions made in dividing the income. Food is first, for without that life cannot be maintained no matter what else may be possessed. This is absolutely essential. It may not be the kind desired, but if it contains proper nutriment the body may maintain its working efficiency. Some of the cheapest foods contain the various nutrients in available form, so that economy along this line is entirely possible. A knowledge of food values will enable one to regulate this column to a nicety, and still the family be nourished in proper form. To buy out of season always adds much to the cost and seldom adds materially to the food value. Some of the most expensive foods, such as meats, have substitutes. If vegetables are not strictly fresh they may have deteriorated decidedly and therefore be expensive. One must be well trained in the business of buying and have a knowledge of food values in order to keep this item within bounds.

Many inexperienced housekeepers order too much or prepare too much. If these left-overs are not properly utilized there will be a leak. Look well to the garbage pail. Keep it free from foodstuffs that can in any way be used. You know that as a class American cooks are wasteful, and that our more thrifty relatives across the seas know much better than we the value of left-overs. Is it true that a French family could be fed on what an American family throws away?

Food must, as before stated, contain the proper nutriment. It must be clean. The standard of cleanliness is constantly rising; greater demands are placed on the producers, with a resulting rise in prices. It must be properly cooked, otherwise a perfect food might be spoiled for use. It must look attractive. There necessarily must be variety; but not so much as some people think. In this respect we may be able to save on the cost of food. Twenty-five per cent is the proportion set aside for this necessity.

It will be noted in the budgets that the smaller the income the higher the percentage spent for food. A man earning but \$500 spends 60 per cent, or \$300, of his income to supply the amount of food necessary. If he has a garden or gets some produce from the farm, the percentage spent for food may seem abnormally low, but these factors must be considered.

Rent or Ownership.

The next item to be considered in Mrs. Richards' "Suggested Budgets" is that of rent or ownership. In securing a dwelling in which to house one's family, many factors must be taken into consideration. These will directly affect the percentage of the income devoted to this end. The wise person is one who secures a house that is not lacking in any sanitary requirement. The nature of the soil and the ease with which the plot may be drained should be two determining factors. Light should be abundant, and a free circulation of air made possible. A good neighborhood should be selected, for the moral side has to be considered in the selection of a home. Many a small house in an unpretentious street or neighborhood may measure up to all requirements in sanitation, outlook, arrangement of rooms and moral tone. There is no question that owning a home helps to develop character. A greater pride in the homestead is usually taken, a responsibility for the general condition of things in its immediate neighborhood, and this interest widens many times into responsibility for the affairs of the community. As the social part of life is of importance this must be reckoned with when considering the question of owning or renting a home.

The amount set aside for rent is about 20 per cent. Not more than 25 per cent of the income should be used unless heat is included, as in apartments in a town or city.

Operating Expenses.

The home having been secured, the question arises as to the maintenance of the same. No house should ever be considered without carefully estimating the fuel required to heat it comfortably, the kind of lighting system afforded and cost of maintenance, and cost of keeping the house clean and in repair. The matter of keeping the house clean should be looked into more carefully than it usually is, as it means pleasure or pain to the housewife.

Aside from these points which help definitely in the choice of a house there are such items as express, postage, car fares (incidental), water tax, and other small expenditures which in the aggregate amount to a surprising sum. It is in operating the house that small leakages occur. As a rule, details are neglected and the bills run up. A strict account kept of all disbursements in this department will many times reveal interesting means of saving without crippling efficiency.

Fifteen per cent plus or minus is indicated in the ideal division, and in all incomes of $1,000 or over it is practically covered by that amount.

Clothes.

The same per cent is indicated for this department as for operating expenses. Certain budgets indicate that more has been spent than the 15 per cent, but these are individual cases. One should buy with a long plan. By this is meant that one winter certain pieces of wearing apparel could be bought, such as a suit, two suits of heavy underwear; the second winter a coat, and in place of the underwear, stockings and shoes. One should be a good judge of textiles and should have in mind the physical need and also the æsthetic need. It is a duty of all mankind to look as well as possible. Neat clothes which are well made, simple in outline and of good wearing material are no more expensive in the long run than those which are untidy in appearance, extreme in style and unsuited to the wearer. Clothes should have a distinctive air. They should look as if they were meant for the individual wearing them.

Higher Life.

Twenty-five per cent in an ideal distribution of funds is set aside for the intellectual and emotional life, — to that which contributes so much to our truest enjoyment. In this list is included sums given to church or philanthropy, savings, which may include insurance and investments, education, travel and recreation. Papers and magazines, books, subscriptions to concerts and the like could be credited to education.

The matter of cultivating a habit of saving and putting aside definite sums each week, month or year, depending on the manner in which the income is received, should be emphasized. Whenever the income will permit this should be regularly done. The habit of saving is worth everything to young people, and will prepare not only for the "rainy" day, but for the sunshiny one as well.

Accounts.

After the question of the proper distribution of the income has been thoroughly discussed, and definite sums apportioned for different purposes, the next thing is to decide on the best way to keep accounts. He would be a poor business man who did not know where his money went after he had earned it. How can one tell where it is best to retrench, if that becomes necessary? Where would it be best to appropriate more in order to lead most efficient lives? Is the doctor receiving a goodly percentage of the income for keeping the homemaker in fit physical condition, while little if any money is spent for help with the housework? Accurate accounts, if carefully studied, reveal much of an interesting nature. Comparisons by months and by years will prove profitable by showing the wisdom or error of the method of expenditure.

What is the best method of keeping household accounts? That method which will give the least trouble, take the least time, and show daily, monthly and yearly expenditures. An elaborate "system" has killed many an honest attempt to keep accounts. Keep them in such a way that a balance can be made at any time between receipts and expenses. Items should be so listed that there will be no difficulty in seeing how much is spent for food, how much for clothing or other purposes.

The account keeper must decide how minutely itemized the record shall be, *e.g.*, are there to be subdivisions under food, such as dry groceries, vegetables, canned goods, meat; under clothes are the individual members to have separate accounts. Operating expenses may profitably have subdivisions such as fuel, lighting, laundry, outside help. The extra time taken to place expenses in the right column will be little and the returns will be great. Above all, make the record fit the family needs. If five columns would show all that was desired as to better ways of expending the income the following year, have five. If seven are needed, have seven. Head them to make them most useful to your family.

The following explanations are given to suggest ways of keeping accounts that are workable: —

Envelope System.

The simplest way of keeping accounts is by the envelope system. This plan, however, seems only advisable when one's income is not much above $1,000 a year, and is received at stated times. Envelopes are marked and the apportioned sum placed inside. When any money is taken the date and amount should be recorded on a slip of paper and placed within. The account should be balanced weekly or monthly, depending upon when the appropriation is renewed. If any money is borrowed from one envelope for another careful record should be kept of it.

Following this method means that many times more money is kept about than is safe or desirable. Also, when money is borrowed from one account for another and not credited there is confusion in balancing accounts.

Note-book System.

An ordinary unruled note book or loose-leaf note book may be used by ruling the pages to suit the divisions of the income; or a family expense book may be bought with printed headings. Two pages should be used for the account. Reference to the specimen pages shown will make plainer the following explanation.

On the extreme left of the first page should be a column for the days of the month. The source of receipts should be noted as well as amounts.

Food has but two divisions, groceries and meat. It seems inadvisable to keep these items in greater detail on such a page. If one wishes to know exactly how much is spent for dry groceries, how much for green groceries, how much for fruit, these accounts can be easily kept by retaining grocers' slips, and entering amounts on a separate page; or by using a small pass book, where items are entered, prices noted and the totals

Expense Account. Month of 19 .

Date.	Receipts.		Food.		House Ownership.			Operating Expenses.				
	Source.	Amount.	Grocer-ies.	Meat.	Interest on Value.	Taxes, Insur-ance.	Repairs.	Fuel, Light.	Wages.	Station-ery, Postage.	Tele-phone.	Express, Freight, Car Fare.
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Monthly total receipts, $

Expense Account. Month of 19 .

Date.	Clothes.	Higher Life.									Daily Total Expenses.
		Church, Philanthropy.	Books, Magazines, Papers.	Lectures, Theaters.	Travel, Societies.	Savings.	Furniture, Household Appliances.	Physician, Dentist.			
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Monthly total expenses, $——————

transferred to a general account book. If the family buys fruits and vegetables out of season it is well to keep careful record of such expenditures, as it is easy to substitute something which will be of equal nutritive value but much cheaper. On the other hand, the itemized account of fruits and vegetables will often show a surprisingly small amount used, and it would be a question worth considering whether more of the income should be used for the purchase of these commodities.

House ownership is indicated in the next division. Interest on the value of the house and the lot is the first subhead. Another includes taxes on house, grounds and gardens; and insurance premiums. There are yearly repairs that should be made and are suggested as a third heading. If car fare has to be paid to and from work, then that too should be reckoned under ownership or rental, as a stated sum must be put by to meet the expenses because of the location of the house.

If a house is rented the headings would be practically the same, — rent would replace interest on value, and taxes would not include the house and land. Many times repairs are made for which the owner does not pay, and these should be noted as repairs as if the property were owned.

Under operating expenses there are five heads; fuel and light, wages, stationery and postage, telephone, express and freight charges and car fare for other than business purposes.

Fuel should include wood, coal, kerosene, alcohol or electricity. If wood is taken from the farm, that item should appear either in the farm records or the household records or both. Kerosene used for the oil stove might be included with the oil for lighting purposes if lamps are used. Alcohol used for a flatiron should be listed under fuels.

Wages should include what is paid regularly to the maid, if one is kept, and the occasional help from outside, *e.g.*, some one to help with the weekly cleaning, laundry work, the cleaning of windows. Laundry may be listed in a separate column if so desired.

The next two subdivisions need no comment, — those of stationery and postage and telephone. The last column indicating car fares means the occasional trips taken by the family and not the regular business trips.

Clothes may well be subdivided according to the members in the family; but it would seem more simple to keep the itemized account on another page in the same book, and record the total expenditures on this sheet.

The last heading, higher life, or, as Mrs. Richards calls it in another place, the "intellectual and emotional" life, receives 25 per cent of the income in the ideal division. This must of necessity be cut down when the income is small, but some allowance must always be made; otherwise the mere feeding, housing and clothing would mean an existence little above the brute stage. Here the divisions will represent what the individual families most enjoy, and the accounts will show whether the expenditures for the things lasting but not material are wisely expended.

Church and philanthropy must surely come in each family record of expense; books, papers and magazines should be found in every home. Library dues should be listed here. Lectures, concerts, theaters, moving pictures are attended frequently and deserve a separate column. Money expended in traveling and vacation expenses form another item under this higher life heading. Savings in the bank, life insurance and stocks and bonds should also be listed. Furniture considered as personal property can be included here, and it is suggested that household appliances be indicated in such a way that the sum yearly spent on these may be seen at a glance. What per cent is spent on such improvements in the home? How much should be spent, taking all things into consideration? Under "physician" and "dentist" should be included all money paid out for physicians, surgeon, oculist, dentist, nurse, medicine and all expenses incurred by sickness. If too large a proportion falls here the matter should be thoughtfully considered to see if the causes cannot be removed.

If other headings are desired space could be used between higher life and daily total expenses.

The daily totals should be calculated and the sums placed in the columns reserved at the extreme right under the caption daily total expenses. At the foot of each column space is left for the totals of each column. The grand total of these totals at the bottom of the two pages should balance with the grand totals of the daily totals. Space is indicated for the monthly total receipts and the monthly total expenses.

In the back part of the account book two duplicate pages should be ruled for a recapitulation by months. When balancing accounts at the close of each month the totals should be carried forward to these pages.

Card System.

The card system is well liked by some people for keeping accounts. In using cards the headings may be the same as those used in a book. Each month the total expenditures should be transferred to a card reserved for monthly totals.

Methods of Payment.

Cash payment is the best method to follow. A checking account in a bank conveniently located is a desirable thing to have and encourages businesslike methods. Grocery and dry goods bills may be allowed to run for a month; but it is not wise to have goods charged for an indefinite time. When cash is paid one cannot spend money that is yet to be earned. When a charge account is kept it is an easy matter to buy, trusting the future will bring money for payment. The installment plan is an expensive one, and should be used only by those finding it impossible to make other arrangements.

It is fitting that this brief discussion of an important subject close with a quotation of Miss Mary S. Snow: "It is meet that women in every part of the land shall seriously study how they will spend the wage so hardly come by on the part of the wage earner, — that wisdom and skill in the spending shall match the earnestness and zeal in the earning."

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ALFALFA FOR NEW ENGLAND.

BY PROFESSOR ARTHUR D. CROMWELL.

FROM THE SIXTY-SECOND ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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ALFALFA FOR NEW ENGLAND.

ARTHUR D. CROMWELL, PROFESSOR OF AGRICULTURE AND BOTANY, STATE NORMAL SCHOOL, WEST CHESTER, PENNSYLVANIA.

WHY GROW ALFALFA?

Life is a never ending series of adjustments. Of one thing we may be sure and that one thing is change. New England farmers have not always understood or remembered this, and hence at times New England farmers have failed to adjust themselves and their farm practices to the demands of the times. Among the changes that are now upon us are the adjustments that are to be made in farming by growing alfalfa. For as Mr. Ellsworth of Worcester, Massachusetts, has said, "Alfalfa is to be grown on every farm in New England."

Alfalfa will enable those who grow it to produce on each acre from 3 to 5 tons of feed, which is pound for pound equal to thrashed oats or wheat bran. At the same time that the alfalfa raiser produces from 3 to 5 tons of feed, equal pound for pound to thrashed oats, he is growing a plant that is storing, in each acre of his ground, from $25 to $30 worth of nitrogen each year. Then, too, alfalfa roots deeper than other farm crops, and it brings up from the subsoil rich stores of potash and phosphorus. But since alfalfa comes to us from the semi-arid regions, we must not expect it to produce good crops of seed in this humid climate. However, since it is a gift of the desert, we are to understand that when dry seasons come, as come they will, alfalfa growers are to have a crop, and, if anything, a better crop. Alfalfa can stand hard winters. Alfalfa is green a month earlier and a month later than other crops, and hence for a man who is practicing the soiling system, alfalfa offers a crop that can be used about two months more each year. Since it grows through the whole summer, it offers a soiling crop that is available every month from the time it is large enough to cut in the spring until long after hard freezing comes in the fall.

Alfalfa is a lime loving plant. It has 34 per cent of lime in its ash, while clover has but 20 per cent and timothy but 4 per cent. Growing animals, dairy cows and laying hens need lime. They need more lime than we are able to supply in corn and mill feeds; hence alfalfa offers a plant that will supply lime to make bone and milk and eggs.

There is no need for a New England farmer spending a cent for feed unless he is feeding more stock than his given area of land can support. I mean the New England farmer does not need to spend his hard-earned profits for mill feeds in order to get nitrogen or protein. He can grow his protein at home and enrich his soil at the same time. We live at the bottom of an ocean of air that is about 200 miles deep and composed of about four-fifths of nitrogen, and yet our profits are small and our cost of living high because we have to pay so much for protein, which we need in order to get that single element nitrogen. Yet alfalfa, soy beans, Canada peas, vetch and the clovers, including sweet clover, have associated with them on their roots bacteria which cluster together into different shaped but easily observed nodules, and which have the rare power of taking from the air circulating in the soil that element nitrogen. These bacteria gather more nitrogen than they need; they gather enough to feed the plant and to lay up an excess in the soil to feed the corn, potatoes or other crops which follow the alfalfa. The story seems too good to tell. You can have your cake and eat it. But alfalfa is going to make the man who succeeds in growing it master of the situation. The alfalfa grower is going to be the man who can buy the adjoining farm. The alfalfa plant is going to bring back to New England the Berkshire, the Chester White and the Poland China hogs, to help lift the mortgage off the old New England farm. Alfalfa is going to enable the farmer in the east to make more on the small farm than the mid-westerner makes on his larger farm of $200 an acre land. Alfalfa is going to make the New England hen cackle two months longer each year. Alfalfa is going to add materially to the beauty of the New Engalnd landscape.

American ingenuity will soon enable some Yankee manufacturers to put onto the market an alfalfa shredded biscuit that will do more than any patent breakfast food or medicine now on the market to make efficient men and women out of our boys and girls. Alfalfa besides putting the kink into the pig's tail while he helps lift the mortgage, besides enabling the old cow to give more milk, the hen to lay more eggs and the boys and girls to be stronger of bone and larger of muscle, besides adding to the beauty of the New England landscape, alfalfa is to add to the contentment and happiness of the people by putting dollars into the farmer's pockets, and thus enabling him to have better homes, to support better schools and churches, and thus fulfill Dean Bailey's four requirements for the real husbandman: "To make a comfortable living; to leave the farm better than he found it; to rear a family carefully and well; to be of service to the community."

How to grow Alfalfa.

To grow alfalfa successfully there are six things, each of which must be very carefully attended to. You may think as others have thought that you can get paying crops of alfalfa by leaving one or more of the six steps undone, but experience will teach you in time that each and every one of the six things must be carefully taken care of. We call these six requisites the six alfalfa secrets, as follows: —

1. Good, well-drained soil.
2. A good, hard seed bed.
3. Plenty of the right kind of lime.
4. Good, acclimated, northern grown seed.
5. Good, abundant soil or seed inoculation.
6. Good harvesting and curing of the hay.

Good Soil.

You will notice that our first requirement is good soil. Alfalfa must have liberal feeding. It is true that alfalfa when once well established will come nearer making its own way, while giving paying crops, than will any other farm crop; yet this fact must be faced, namely, during the first year alfalfa plants are delicate little plants which respond readily to liberal feeding. This means that we get more from the money spent for available nitrogen, potash and phosphorus to put on the ground, which we are to seed to alfalfa, than we get from the money spent for plant food for most other farm crops.

But how is a man to know what to feed his alfalfa plants? My answer is ask your farm bureau agent, if you have one. He should have gathered some valuable information from the experiences of the farmers of your district, and he should have at hand what the experiment stations know as to what alfalfa needs. The next best source of information after your farm bureau, is your experiment station. Write to your experiment station and ask the men there what they know about feeding alfalfa. Your land may not be of the same kind as that on which they have experimented, and hence you may need other help. I can think of no place more valuable for one to come, once a year, than to a gathering like the New England Alfalfa Association meeting, and there compare notes and hear the experiences of farmers who have been growing alfalfa. But when all is said and done you must do a little experimenting on your own farm. Sow different strips on your alfalfa field with different amounts of the different fertilizers and then watch for results. But to start alfalfa you will want to have a rich soil, and you will need to use something like 500 pounds to an acre of a mixture of about 3 per cent of nitrogen, 8 per cent of phosphoric acid and 10 per cent of potash.

Select Well-drained Soil.

Alfalfa comes to us from the semi-arid regions of southern Asia. To be sure it has been grown in Europe for centuries, and in America for some years, yet it shows its desert origin by demanding a well-drained soil. Alfalfa will not live with its feet in the water. It will do well on loose sandy or stony soil. Alfalfa will thrive on a stony hillside so full of rock and so dry that corn will not develop an ear. I know of two pieces on such soil, one has been down for five years and the other for eight. The soil is so dry and sandy that blue grass and plantain, the two worst weed enemies of alfalfa, have not gotten a foothold. Of course a man gets more alfalfa on better ground, but he gets more dollars worth of feed from such a stone patch than he can get from seeding it to any other plant, unless it be sweet clover.

Alfalfa seems to prefer a southern slope. I think that this is explained in part by the fact that southern slopes are dryer in fall and winter. Perhaps the ground is sweeter and does not heave so seriously. Alfalfa can stand more cold than most other plants. After the first year it does not winter kill in a temperature from 20° to 30° below zero. Alfalfa is green a month longer in the fall and a month earlier in the spring. Perhaps the southern slopes are favorable because alfalfa can get a better growth for winter covering in the fall, and an earlier growth in the spring. This does not mean that you cannot grow alfalfa on northern slopes. It does mean that I advise the beginner to start his first patch or two on his southern slopes.

One of the great problems in America is the conservation of the soil on our hillsides. Alfalfa once well seeded may be left on a hillside for ten years; then if plaintain and grass come in, the patch may be plowed up, cultivated for a half year and seeded to alfalfa for another ten years. This makes alfalfa better than orchards for holding the soil on the hillsides.

Low, wet ground is apt to be sour. It will grow alsike clover, timothy, cow peas, red top and corn, for these are more tolerant of acid in the soil. Cow peas, alsike and red top seem to thrive best where the soil is slightly acid. But alfalfa will not grow on sour soil. It winter kills and the bacteria fail to thrive. Some men have used tile drains and have converted low, coastal plain or river bottom soils into the best of alfalfa soils. Alfalfa being a gift of the desert demands a dry, well-drained soil.

Prepare a Good, Clean, Hard Seed Bed.

When we have studied how to grow alfalfa as long and as diligently as we have studied how to grow corn, we shall laugh at the man who gets less than 5 or 6 tons to the acre, and some of you will be getting much more. But when we have learned how to grow alfalfa, we shall have learned that the seed is very, very small, and that for some weeks the little alfalfa plant is a very delicate little thing. That means that it cannot hold its own against many of the weeds. You can kill the weeds by disking and plowing, by cultivating and hoeing before the alfalfa is planted on the ground. But once the alfalfa is planted, you are doomed to partial failure if you have sown the seed on ground infested with weeds. You must sow alfalfa on a clean seed bed in order to succeed well.

The seed bed should be hard. I would hardly expect to succeed with alfalfa if I plowed the ground just before sowing the seed. I would much prefer disking to plowing before seeding. Where alfalfa is seeded in August, following wheat or oats, disking gives better results than plowing. But wo do not disk to save time. We must disk and disk until it takes as much time as it would to plow. However, the disking leaves a hard seed bed underneath, it gives us a garden mulch on top, and it leaves the stubble on the surface to act as a partial shade and to keep the soil from washing. Plowing, especially after a coat of manure or heavy coat of stubble is plowed under, causes the soil to dry out too rapidly and too deeply. Even oats, with a seed much larger than the little alfalfa seed, frequently do better on disked ground than on plowed ground. But if there are weeds, if the ground has been in oats, say, and the oats have been cut early for hay, then the ground may be plowed, the deeper the better. and the weeds thoroughly killed. After the plowing the ground should be rolled, disked and harrowed frequently to germinate and kill all weed seed and to give a good, hard seed bed underneath, with a clean garden mulch on top. Remember that you are seeding the alfalfa for from three to ten years to come, and it pays to do it well. You can easily reduce your alfalfa hay crop 1 to 2 tons for a number of years to come by not preparing a good seed bed. Think of a man's shortening his yield 2 tons of hay, worth $20 per ton, and that for three to ten years to come, and all of this loss to save a day's labor when preparing a seed bed. The seed bed should be clean enough and soft enough to do for an onion bed. It pays to have a clean, hard seed bed.

Apply Plenty of the Right Kind of Lime.

There are a number of things which we have to learn about liming. But of one thing we are certain, no farm crop requires more lime than does alfalfa. This may be because the bacteria which furnish the nitrogen for the alfalfa are very sensitive to sour soil. It may be, and undoubtedly in part is, because the bacteria that should thrive on the alfalfa roots are most easily killed by acids in the soil. However, I believe that there is another reason. The alfalfa plant has 34 per cent of lime in its ash, clover has 20 per cent and timothy has 4 per cent. I believe that we are just beginning to learn our A B C's of lime for animal and plant foods. I believe that when the truth is fully understood, we shall know that one reason why alfalfa is so good for growing animals, for poultry and for dairy cows is because of its high per cent of lime. If this proves to be true, there is no way known to the farmers of to-day by which they may make money faster than to sow lime on the land to feed alfalfa, which in turn is to feed animals and hence return to him in beef or milk, which sells at many times over the cost of the agricultural lime.

There are two materials called lime, and they come to us in three forms. One material is dolomite, which is a magnesian-calcium carbonate. I believe that when we fully understand the lime problem, we shall have learned that the magnesium lime is not to be used for alfalfa. Hall says the English farmers learned years ago that the dolomite is not good for repeated applications. Do not misunderstand me. Magnesian lime will neutralize acids as readily as pure calcium lime, but I do not believe that the neutralization of acids is all that there is to liming for alfalfa, nor do I believe that sweetening the soil is half that there is to liming for alfalfa. I believe that calcium is a very necessary plant food for alfalfa, and hence well worth feeding the plant in abundance.

Lime comes to us in three forms, — caustic or burned, hydrated or slaked and in the form of ground limestone. Only unburned, ground limestone is to be recommended for applying immediately before sowing alfalfa. Burned lime is believed to be injurious to the alfalfa bacteria. Hydrated lime is but little better. Moreover, these forms are hard on the men who handle them, while ground calcium limestone is believed to be beneficial to men, especially men of weak lungs.

Of course where one has to pay freight on a long haul, and where one can apply the burned lime some months preceding the planting of the alfalfa, it may pay to use burned limestone.

Use Good, Acclimated, Northern Grown Seed.

Our people get the best results by using 30 pounds of seed to an acre. That should be too much. There are places where men have used as little as 6 quarts (12 pounds) with timothy and clover. In time the timothy and clover disappeared, the alfalfa survived and made a good stand that yielded three or more tons per acre. Twenty pounds to an acre should be enough, providing we use a disk drill and use good seed. But good seed is hard to get. I fear that the seed houses palm off on the eastern farmers entirely too much of the Asiatic seed. I fear that at times farmers are led to believe that the Turkestan seed is superior. Then, too, I fear that entirely too much southern grown seed finds its way this far north.

Massachusetts requires good seed, from plants that have been grown in the United States for some years and from States as far north as Montana. How can you get it? Well, one way is to have one of your farm bureau agents go west and find a reliable grower and then buy of him. Another way is to find a reliable dealer and then put it up to him to furnish you good seed at a reasonable rate. I found that we could get for the members of our farm bureau good seed at $7.80 per bushel of 60 pounds, and that at a time when other farmers were paying $13 and $15 for the same seed. It strikes me that there is nothing that your State association can do that will help more than to discover among yourselves a member who knows where you can get good seed; then have him arrange so that you can get seed from him or his dealer. We have a form or legal paper which a man may deposit in his local bank with the money for the seed. The form provides that when the seed arrives, the bank pays the bill and that automatically releases the seed to the buyer.

Of course members of this association will not run the risk of planting seed until their farm bureau agent or their State college men have examined and tested their seed. There is too much danger of dodder. After I had examined the seed from one seed house, and had Pennsylvania State College examine it, and had the men in the United States Department of Agriculture at Washington examine it, I found that the seed house had sent a farmer seed in which he might plant thirteen dodder seeds to a square rod. If you once get dodder on your place, you will probably be unable to grow paying crops of alfalfa for five or more years. My advice is to have samples of the seed examined by some one who knows how to examine and test alfalfa seed. But even that does not assure you that it is northern grown seed. Therefore, get seed from a reliable seed man, pay him a reasonable price, but give him to understand that he is to be responsible for the delivery of first-class northern grown, acclimated seed.

Give the Soil or the Seed Abundant Inoculation.

There are two ways to inoculate. One way is to go to a field where alfalfa is being grown and where there are plenty of nodules on the roots and take the soil from there and spread the soil over the field which you intend to sow to alfalfa. There are people who will tell you that 200 or 300 pounds of soil will do. That may be true where you can sift the soil and seed or sow it with a hand seeder, but I think that a man can better afford to use 2 tons than 200 pounds of soil. If I were going to grow alfalfa, I would put in 2 or 4 square rods of ground. I would put this into alfalfa in the spring. I would inoculate it heavily, and then from that patch I would get soil for my field.

For field inoculation I would use the manure spreader. I would go to a piece of ground where the nodules are thick, shovel off about 2 or 3 inches of the surface soil, and then load the spreader with the soil that lies from 3 inches to 15 inches below the surface. Then I would drive to the land which I intended to sow in alfalfa. There I would put the spreader in gear, let it run until the dirt began to pile up near the rear of the spreader, then stop and crank the load to the front and then go ahead again. When the dirt was again piling near the rear end of the spreader, I would again shovel or crank it back to the front. You will do well to make a big load cover a half acre. But you can give an acre two loads with less labor and bother than you can putter around with 200 pounds, if you have to sift it and use a hand seeder. Three or 4 tons of soil are not too much. The soil should be spread on a cloudy day, and it should be harrowed in at once. I do not need to say that you run the risk of sowing plant diseases. Hence it is necessary to be very cautious to get soil for inoculation from land free of disease.

We have found that the commercial cultures give us better results and cost us less than the soil inoculation. Of course I think both are better than either alone. You can get enough culture for an acre of seed for $2, and you can hardly take a man and team and spread your own soil for less than $2 per acre. The inoculating of the seed is a simple process. The directions that come with each batch of the culture give one ample information as to just what to do to inoculate the seed. We have had good results from the use of the commercial cultures. The United States Department of Agriculture at Washington is very liberal with their cultures, and hence most of you can get the cultures free by asking for enough to inoculate seed for the number of acres which you intend to sow. Again I wish to tell you that I think you should sow something like 4 square rods the spring before you sow your field. Give the seed for the little patch double inoculation. You may sow a few square rods in the corner of some pig or cow lot. What you want is a rich well-manured plot in which you may get the bacteria to grow. You may seed this with a little oats to help keep down the weeds. Mow the oats for hay. Of course you will select some place where you can well spare a few inches of the soil and where the shoveling will not be hard.

Your main crop should be planted in August. This enables you to kill the weed seed. It enables you to get a crop of oat-hay or oat and Canada pea-hay or a crop of early potatoes. Now, if you have your little patch in which you have been growing the bacteria, and if you seed in August, you have your own soil for inoculation. Do not underestimate the importance of inoculation. After the alfalfa is once well started you will get 1 to 2 tons per acre more each season as a result of good, abundant inoculation. But that is little more than half of the story. If you have abundant inoculation, your alfalfa is to gather for you and store in your soil from $20 to $30 worth of nitrogen each year after the first year. This you are to get back in increased yields of potatoes and corn and in richer protein content of corn and grain for years after the alfalfa is plowed under.

You ought to work out a crop rotation by which you can leave your alfalfa down for three or more years. If you leave the alfalfa down for three years, and if you had plenty of bacteria on the roots, you should have land that is at least $50 per acre richer in nitrogen when you plow it up.

Harvesting Alfalfa Hay.

After having grown a crop which is equal pound for pound to thrashed oats or wheat bran, a man can very easily lose much of it by improper handling. He may injure his stand of alfalfa very materially by cutting too early or too late. Alfalfa must be cut when the little sprouts at the crown are well started and are yet not high enough to be cut off by the mowing machine. If mowed too early, they are little delicate, white sprouts that cannot stand the exposure to the bright sunshine and cannot yet make their own food. If cut too late, the plant may have accomplished its natural life work of reproduction and hence die a natural death; or the mowing machine may clip the top buds of each of the stems that were to have made the next cutting. Then, too, if one cuts alfalfa in a humid climate, especially where there is much moisture in the ground, and cuts it in the forenoon, he cuts it when there is most moisture in the stems and leaves. The hay is longer in curing, the bacteria of decay have a longer time to work, and hence the hay is of less value. But if one cuts in the afternoon, when the stems and leaves are wilted, he is able to put up the hay sooner, it is dryer and richer, and in every way better. Of course this does not offer so favorable a labor schedule, but alfalfa hay is rich enough in food elements so that some extra labor can well be used in harvesting it.

But the man who does not understand alfalfa will suffer the greatest loss, because he does not use the hay caps. The alfalfa leaf is the richest part of the plant. Horses do not like leaves so well, but cattle and chickens like them better. But the leaves are very readily shattered off unless the hay is cured under the hay caps. Some people make the mistake of having caps that are too small. The caps should be at least 50 by 50 inches. The corners may be fastened with weights or wire pins. Weights are made by filling small plant pots with cement into which has been placed a wire loop or hook. Wire pins are most pleasing to some. The pins are made by cutting a good strong wire into foot lengths and then bending a hook or loop at one end. The pin is jabbed into the hay under the cap and thus holds the corners down and the cap on.

Summary.

Why grow Alfalfa?

1. Alfalfa is pound for pound equal to thrashed oats.
2. It pays better to grow alfalfa than to buy mill feeds.
3. Alfalfa requires less work than is required to grow other farm crops.
4. Growing animals, hens and dairy cows need lime, and alfalfa furnishes most lime.
5. Alfalfa is the most drought resistant farm crop.
6. Alfalfa gives us most protein per acre.
7. Alfalfa does most to improve the soil because (*a*) it roots deepest; (*b*) it gathers and stores in the soil most nitrogen.

How to grow Alfalfa.

Six alfalfa secrets: —

1. Good, well-drained soil.
2. A good, rich, hard seed bed.
3. Plenty of the right kind of lime.
4. Good, acclimated, northern grown seed.
5. Good, abundant soil or seed inoculation.
6. Cut at the right time and cure in the right way.

A Dozen Alfalfa Don'ts.

1. Don't sow on weedy soil.
2. Don't sow on poorly drained soil.
3. Don't seed a large acreage to begin with.
4. Don't say alfalfa can't be grown in New England.
5. Don't sow on any but sweet, well-drained soil. Alfalfa is a desert plant.
6. Don't sow on any but a well-prepared, well-settled seed bed.
7. Don't fail to give ample inoculation; both seed and soil inoculation are best.
8. Don't pasture the first year, and don't pasture when wet.
9. Don't feed alfalfa as you do hay, feed it as you do grain.
10. Don't spend your hard-earned money for protein feeds; grow alfalfa, clovers, Canada and cow peas and soy beans.
11. Don't lose the leaves; they are the best part of the plant. Use hay caps.
12. Don't give up. Many prominent alfalfa growers succeeded after some failures.

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Factors Affecting Economical Milk Production.

By Professor C. H. Eckles.

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FACTORS AFFECTING ECONOMICAL MILK PRODUCTION.

C. H. ECKLES, PROFESSOR OF DAIRY HUSBANDRY, UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI.

The day of cheap feed for cattle as well as of food for man is past in this country. Never before in the history of the world has such an area of wonderfully fertile and easily tillable land been brought into use within the span of a lifetime as was done in the Mississippi valley during the past century. As a result of this enormous increase in the production of foodstuffs, and the low price which resulted, both the American consumer and the American farmer developed habits which they do not propose to give up without a struggle. The consumer, on the one hand, became accustomed to cheap food, and it was only a few years ago that the standard price of milk in my State was 5 cents per quart. Now, when there are no immense areas of new land to bring into cultivation, and the population is catching up with the production of food, the inevitable result is higher prices for food, and the consumer is certain some one is robbing him because the cost of living has advanced. The consumer does not realize that the farmer who produces the food to-day is making only fair wages, and on the average probably less than he did ten or twenty years ago.

On the other hand, the tendency on the part of the farmer, with cheap feed for his animals, with a soil of great fertility to draw upon, has been to develop most wasteful habits in production. For example, it is only since feed became so high that it is impossible to carry on a dairy business with poor cows, that the milk producer has begun really to give attention to the selection of the individual cow.

It is the necessity of the times that is compelling the adoption of business systems in dairy farming operations. At present a large portion of the United States is in a period of transition from a temporary to a permanent condition of agriculture. The consumer need not expect cheap food again, neither can the producer expect to continue in business if he does not use methods of keeping down the cost of production which were not thought of a few years ago. It is certainly to be hoped that some means of decreasing the cost of distribution of food products, and especially milk, will be worked out. Unless some means can be found to accomplish this result the consumer must expect to pay more for milk in the future than at present.

Since I am not familiar with New England conditions, I can speak only for my own State, and others similarly located, in saying that the average man who sells market milk to-day is hardly making wages for himself and family, provided everything, including interest on investment, be taken into account. If the average man is doing no better than this, it is evident many are not making even current wages, or savings bank interest on their investment. On the other hand, there are plenty of men who are not only making a good income but in addition are constantly increasing their capital by paying on their farm or buying additional land. I doubt not that a similar variation in income exists among New England farmers supplying your many cities with milk. The farmer below the average, like the cow below the standard, is bound to be eliminated. While I do not believe the price paid the farmer for milk is high enough at present in my section of the country, at the same time I do not believe that the price ever will be raised sufficiently, nor should it be, to allow the slipshod farmers who now rank as below the average to continue in business.

The Conditions in the Middle West.

The eastern farmer is generally inclined to look upon the milk producer in what he calls the west as having great advantages in the way of cheaper feed. In the past this has been probably more of an advantage than it is at present. While the cost of feed is somewhat higher in the eastern States, the market price of milk is also correspondingly better. It is questionable if the farmer who produces market milk in Illinois, Wisconsin or Missouri has conditions any more favorable, taking everything into account, than in the New England States.

It should be kept in mind that the production of milk on the farms in the Mississippi valley is largely a side line to other lines of farming. This is especially true of the cream, which supplies the numerous butter factories which make Minnesota and Iowa the center of the butter producing industry. This cream comes from farms where the owners are, as a rule, producing several articles for market, among which cream is of more or less importance. On these farms the average number of cows milked is about ten. It is almost impossible to estimate correctly the actual cost of keeping cows under these conditions. It is difficult even to estimate the cost of the feed. A considerable portion of their ration consists of roughage in the way of grass, corn silage, hay, etc., which could not be marketed to advantage, if at all, and the labor of caring for the animals is largely done by members of the family. Under these conditions it is possible to keep a limited number of animals on a farm with very little additional expense. This accounts for the fact that a State like Missouri keeps 750,000 cows, and the farmers consider they are making money in spite of the fact that the average production is only about 4,000 pounds of milk and 160 pounds of butter fat. This is the typical condition in the corn-belt States.

If an attempt were made to keep the same cows under conditions where the feed was purchased at market price and the labor was paid at current rates, these average animals would show not a profit but a loss. At the same time under the conditions existing, they are undoubtedly kept at some profit. The men who produce market milk in my State average a little high in total production per cow, securing on the average between 5,000 and 5,550 pounds of milk.

The following figures give the actual feed consumed and its cost for a year for three Missouri Holstein cows averaging 8,426 pounds of milk, and for three of the same breed averaging 5,709 pounds: —

TABLE 1. — *Three Holstein Cows averaging 8,426 Pounds Milk.*

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	2,216	$14 00	$14 79
Silage,	5,363	3 50	9 39
Corn,	1,808	22 00	19 88
Bran,	904	20 00	9 04
Cottonseed meal,	452	30 00	6 78
Pasture five months,	–	1 50[1]	7 50
	–	–	$67 38

Feed cost per 100 pounds milk, $0.80.
Total value milk, $1.50 per hundredweight, $126.39.
[1] Per month.

TABLE 2. — *Three Holstein Cows averaging 5,709 Pounds Milk.*

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	2,048	$14 00	$14 34
Silage,	4,082	3 50	7 14
Corn,	1,016	22 00	11 18
Bran,	508	20 00	5 08
Cottonseed meal,	254	30 00	3 81
Pasture five months,	–	1 50[1]	7 50
	–	–	$49 05

Feed cost per 100 pounds milk, $0.84.
Total value milk, $1.50 per hundredweight, $85.63.
[1] Per month.

It is seen from these figures that in the State mentioned it cost $60 to $70 to feed a cow that will produce 8,000 to 8,500 pounds of milk, or about 80 cents per hundred pounds. Those averaging 5,709 pounds required about $50 worth of feed, or a cost of 84 cents per hundred. The prices of feed used are about the average prices with us for the past five years, and represent, except in the case of silage, what these feeds could be purchased for on the market. These cows represent ordinary producing animals of their breed. These figures, it should be understood, are based entirely upon actual weights of all the feed and milk produced.

Figures are also given below of the actual feed consumed by three cows having quite a wide range of production. These animals were not on pasture, but received practically the same ration throughout the year.

TABLE 3. — *Amount and Cost of Feed for Three Cows of Different Milk-producing Capacity.*

Holstein, 11,987 Pounds Milk.

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	5,685	$14 00	$39 79
Silage,	7,946	3 50	13 91
Corn,	1,920	22 00	21 12
Bran,	960	20 00	9 60
Cottonseed meal,	480	30 00	7 20
	–	–	$91 62

Feed cost per 100 pounds milk, $0.76.
Total value milk, $1.50 per hundredweight, $179.90.

Ayrshire, 9,169 Pounds Milk.

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	4,807	$14 00	$33 65
Silage,	5,550	3 50	9 71
Corn,	1,644	22 00	18 08
Bran,	822	20 00	8 22
Cottonseed meal,	411	30 00	6 17
	–	–	$75 83

Feed cost per 100 pounds milk, $0.83.
Total value milk, $1.50 per hundredweight, $137.53.

Shorthorn, 5,573 Pounds Milk.

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	4,023	$14 00	$28 15
Silage,	5,950	3 50	10 41
Corn,	1,140	22 00	12 54
Bran,	570	20 00	5 70
Cottonseed meal,	285	30 00	4 27
	–	–	$61 07

Feed cost per 100 pounds milk, $1.10.
Total value milk, $1.50 per hundredweight, $83.59.

We could give a large number of similar figures of which these are representative. On the basis of our figures, which are based not upon estimates but upon actual records, and which

I believe fairly represent practical conditions, we can make a fair estimate of the cost of feed required for producing milk in my State during the past five years.

TABLE 4. — *Estimated Cost of Feed in Missouri.*

PRODUCTION PER YEAR (POUNDS).	Cost of Feed per Year.	Average Cost per 100 Pounds.
5,000-6,000,	\$50 00-\$60 00	\$0 85-\$1 00
6,000-7,000,	55 00- 65 00	80- 95
8,000-10,000,	65 00- 80 00	75- 85

It is, of course, recognized that the cost of feed, while the largest single item, is only one among several that go to make up the total cost of milk production. It is an exceedingly difficult matter to give a fair estimate of these other factors entering into the cost of milk production. Even as regards feed there is some difficulty, since the cattle make use in part of feed that could not be put on the market, and which therefore can hardly be said to have a market price. In Missouri the production of milk, as stated, is so closely connected with general farming operations that it is practically impossible to separate the labor items. In many cases the milking is done largely by younger members of the family and in that way some income secured for their services, which probably would not be had at all if it were not for having this particular work to do. There are certain items that of course can be estimated with reasonable accuracy, as, for example, the cost of maintaining the herd bull, and the interest on the investment; and it is fairly easy to estimate the depreciation in the value of the cow. I regret that I cannot present some accurately taken figures that would give us definite information for conditions as existing in my State. The best estimate and most complete figures on this subject of the cost of milk production in addition to the feed is found in a bulletin from the New Hampshire Experiment Station by Professor Rasmussen. He estimates the cost of keeping a cow to be \$50 per year in addition to the feed.

While the cost of feed is somewhat lower in the Mississippi valley States than in the east, the market price of milk is also lower. A fair estimate of the amount received by farmers in Missouri during the last five years, for milk sold at wholesale to go to the cities, is $1.50 per hundred pounds. The average price for butter fat at creameries has been around 28 cents and in some places probably even less, giving an income of not much over $1 per hundred for milk sold to creameries, exclusive of the value of the skim milk used on the farms for feeding purposes.

There is no question but that a portion of those producing cream for the creamery or milk for cities in Missouri are not making their expenses, that is, either they are not themselves getting current wages or are receiving less than current interest on their investment, or probably both. A large number are really making a small profit, that is, a fair return for their work, while a smaller number are making large profits for the time and money expended. To put it in another way, those who manage their business skillfully are realizing a good market price for their feed at home, and are receiving good pay for their labor and interest on their capital.

Is it possible to produce Milk at a Profit at the Present Prices?

It seems to me that it is fair to raise the question as to whether or not it is possible to produce milk at a profit under present conditions. If it is being done by some, would it not be worth while to study the conditions under which they are doing it? The difficulty in considering the question, as already intimated, is the impossibility of getting a fair estimate as to the various items that contribute toward the expenses of milk production outside of feed. There is plenty of evidence that certain men are producing milk at a profit; at least we have such evidence in my State. We can point to farmers who began twenty years ago with little capital and who have paid for their farms and have a valuable herd of cattle, and who have done so by the production and sale of milk. Unquestionably, similar examples could be cited in other States. Further than that we can refer to actual figures as taken from various sources.

The following two tables, taken from our records, show the amount of feed used and the cost of feeding a Jersey cow for a year, also the production of milk and fat from that ration: —

TABLE 5. — *Ration fed a High-class Jersey Cow.*

	Pounds fed.	Market Value per Ton.	Cost of Amount fed.
Corn,	1,376	$20 00	$13 76
Bran,	688	23 00	7 91
Oil meal,	344	33 00	5 68
Alfalfa,	2,694	15 00	20 20
Silage,	4,575	3 00	6 86
Pasture four and one-half months,	–	2 00[1]	9 00
	–	–	$63 41

[1] Per month.

Total cost of the feed consumed by this animal was $63.41. Had this animal been capable of producing only 200 pounds of butter fat in a year, this feed bill would certainly look excessive. During the year, however, her production was as follows: —

TABLE 6. — *Production and Income from High-class Jersey Cow.*

Milk (pounds),	7,940
Fat (pounds),	484
484 pounds fat at $28\frac{1}{2}$ cents equals	$137 94
635 pounds skim milk at 20 cents per hundredweight equals	12 70
	$150 64

The price given per pound of butter fat was the local creamery price during the time this butter fat was produced. The skim milk value is placed at what it sells locally for hog feed. The income from this cow was $150.64 for the year, leaving the calf out of the consideration and figuring on the basis of creamery prices. Granting the accuracy of the estimate by Professor Rasmussen of New Hampshire, that it costs $56 in addition to the feed to keep a cow in milk a year, there still was a margin of $31 after deducting the $119, which would cover all expenses, including labor, interest and depreciation. A cow like this beats any railroad proposition in the country. A railroad is expected to make only good interest on its investment after paying labor charges and depreciation. What railroad can show, as this cow did, a clear profit of one-third the cost price in a year? Take the figures as already given of the Holstein cow producing 11,987 pounds of milk at a feed cost of $91. Had this cow been on pasture, it would have reduced her feed bill several dollars, but at the figures given we can add on the $56 estimated by Professor Rasmussen for other expense, and still, had her milk been sold at the local price of $1.50 a hundredweight, the income would have exceeded the expenditure $33.90.

Whenever figures have been collected regarding the income from herds or from individual cows, the same wide variations in income, as pointed out, have been found. There is one fact, however, that always stands out strikingly, and that is, economical production is found only with high-producing cows. The figures already given, showing the cost of production by cows of different grades, illustrate the facts in this connection clearly. The three Holstein cows producing 8,426 pounds of milk in a year did so at a cost of 80 cents per hundred, with an average income of $126.39, counting milk at $1.50 per hundred pounds. The three Holstein cows producing 5,709 pounds of milk per year cost only $49.05 for feed, but their income was only $85.63. In other words, for $17 additional feed, when given to one of the better cows, $40.76 worth of additional milk was secured. The other items of cost, such as labor, stabling, etc., would be practically the same for both animals. Figures as given for the three individual animals are still more striking. The cow producing 11,987 pounds of milk did so at a cost of $91.62 for feed. The cow producing 5,573 pounds of milk, or practically one-half as much, required feed to the amount of $61.07. At $1.50 per hundred pounds the difference in the income of these two animals would be $96.31 per year. The difference in the cost of feed was $30. The following figures, taken from the bulletin issued by the New Hampshire Experiment Station already mentioned, illustrate the same condition: —

TABLE 7. — *New Hampshire Cow Test Association Records, 203 Cows.*

NUMBER OF COWS.	Production (Pounds).	Cost Feed.	Cost 100 Pounds Milk.	Income above Feed.
8,	Above 10,000	$88 59	$0 81	$106 82
14,	9,000-10,000	88 25	93	79 18
26,	8,000- 9,000	83 46	98	63 86
41,	7,000- 8,000	81 18	1 10	52 11
40,	6,000- 7,000	73 59	1 13	43 65
39,	5,000- 6,000	65 91	1 19	34 56
25,	4,000- 5,000	56 61	1 23	27 20
10,	Under 4,000	57 22	1 86	4 25
Average for all,	7,094	$73 61	$1 04	$49 48

It will be noted that cows producing above 10,000 pounds of milk did so at a feed cost of around 80 cents per hundred pounds. Those producing 5,000 pounds cost about $1.20 per hundred pounds, while those going under 4,000 pounds showed the exceptionally high cost of $1.86 per hundred. Here we have exactly the same point illustrated. A low-producing cow, especially the cow producing less than 5,000 pounds of milk a year, is the animal that shows very high cost of production, and it is only necessary to have a few animals of this kind in the herd before the chances of running the business at a profit are gone.

It should be pointed out that in each case the high-producing animal uses more feed. This is inevitable. There is a good deal of loose thinking and talk concerning this point among dairymen, and especially among others who at times attempt to advise them. It is even stated that it costs as much to keep a poor-producing animal as it does a good one. This is true in regard to certain items of expense, such as stabling, labor, insurance, etc., but it is not true and cannot be true with reference to the feed. The animal that is a large producer must have more feed. And the fact that she is a large producer and requires more feed is the reason she is a more economical producer. In order to make it clear where the economy of production comes in with the high-producing cow, I have prepared the following table: —

TABLE 8. — *Use of Feed by Cows of Different Producing Capacities.*

	For Maintenance (Per Cent).	For Milk (Per Cent).
Cow giving 4,500 pound of milk,	60	40
Cow giving 9,000 pounds of milk,	40	60

Under the term maintenance is included the feed necessary to maintain the animal's body. In case of animals producing 4,500 pounds of milk, about 60 per cent of the feed is used to support the body and about 40 per cent is used for producing milk. With the animal that produces 9,000 pounds of milk a year, the condition is reversed. While she uses the same amount of feed for maintenance, she uses 25 per cent more feed than the first, which it will easily be seen gives her twice as much feed available for milk production. This table shows that in general one cow using 25 per cent more feed than another may produce twice as much milk. The economy in the high-producing cow lies in her ability to use a larger amount of feed after enough has been provided for the maintenance of the animal.

This is the simple but entire explanation of the difference in economy of producing milk by different cows. It is not difference in digestion of food, or that one has a power to get something out of her ration that another cannot.

HOW TO GET THE EFFICIENT COW.

It would be interesting, and it might be profitable, if limitation of time did not prevent, to consider in some detail as to how the high-producing cow is to be secured. Time will be taken to discuss only one or two points and those only briefly. The first is that in order to secure profitable cows for the dairy herd, the dairyman must raise them himself. I am fully aware of the situation in regard to the expense of raising a calf where the whole milk is sold, but at the same time there is absolutely no other way for a farmer to increase the quality of his herd. There are herds in my State that have been maintained for twenty years or more entirely by purchase, and these herds to-day, as far as we can find out, are not one bit more productive than was the herd owned by the same man twenty years ago. Absolutely no progress has been made and never will be made until the owner raises his own dairy cows. This will involve, of course, giving closer attention to the matter of breeding. It will not pay to raise a dairy heifer unless the chances are good for her to be a profitable cow when mature, that is to say, she must be given the right inheritance as far as possible in order that the number of cows that will have to be rejected by selection will be reduced to the minimum. After the cow is raised and in milk, the only salvation of the dairyman is to keep records of her production. This may be done to good advantage through the cow-testing association or by the owner himself.

It is not necessary to milk a heifer long to find out if she is a good one or not. Last year I compiled the records of our herd, which are complete for twenty-two years, and I found that in only one case would we have been far wrong had we culled out the inferior cows on their first year's record. It is a mistake to keep a young cow year after year thinking next time she will be a good one. Our rule is that unless there is some good excuse apparent for her poor performance, we condemn a heifer that shows up poorly the first year.

Another question that I might discuss in detail, if I had the time, in this connection, is that of heifer raising and to what extent the manner of raising affects the dairy qualities of animals when mature. In other words, is the inferior or superior cow, from a milking standpoint, born that way, or is she made what she is by the manner of feeding and treatment when young? We have been carrying on investigations along this line for a number of years. Our conclusions so far are, that the dairy qualities of an animal are mostly dependent upon heredity, and that you cannot to any great extent, at least, affect the dairy qualities of the animal by the way she is fed or managed when young. We would, of course, not go so far as to say it is not possible under very abnormal conditions to injure the milk-giving functions by the way she is raised, but it would be necessary to go beyond ordinary practices to get any such effect.

We are convinced that the milk-giving characteristics are hereditary, but it should be clearly understood that we do not think the amount of milk that a farmer secures from his cows has been taken out of his hands and is to be attributed entirely to the ancestors of his herd. Such is certainly not the case. By the milking qualities of an animal we mean simply her capacity as a milk-producing machine, and in order to get good results from any piece of machinery we must have an efficient operator. So the inherited dairy characteristics of the cow are the first requirement, and the next is that this machine be handled by some one skilled in its management.

The Feeding Question.

It is not my purpose to discuss the subject of feeding in detail, as I am not familiar with the local conditions and problems, but I desire to take up a few points that I consider of the greatest importance in regard to the fundamental principles of successful feeding. I have already emphasized as best I could the importance of selecting the cow that has the ability to produce large quantities of milk as the starting point for economical production. In Missouri, and I think the same is true in a number of other States, before we can begin to select cows we must first give them an opportunity to make good. If a cow does not receive a sufficient amount of feed, or the ration is unsuitable for producing milk, it is unwise to say she is an inferior producer and sell her. The first thing to do, and the step that must precede the selection of the cow, is to make sure the conditions for production are right. Then if she does not respond, she cannot be sold too quickly.

In the section of the country with which I am familiar, the most common mistake made in feeding cows is not to give them enough. Many of the farmers are more accustomed to feeding steers and hogs than they are to feeding dairy cows. While they recognize that to fatten steers economically the animals must have all the feed they will eat, they do not understand that exactly the same thing holds with a dairy cow. If I see the proposition correctly, you cannot afford to keep cows that are not well fed. It may be that you cannot afford to keep the cows you have at all, but certainly you cannot afford to keep them without using what capacity they have to produce milk.

The dairy cow in a way may be looked upon as a milk-producing machine or factory, and like all factories there is a certain amount of fixed charges that have to be met. With a cow of fair-producing capacity, about one-half her feed is used to maintain the functions of the body without returning anything in the way of product. It is the second half of her ration that is used in producing milk. That is, if it costs us $70 to feed a certain cow in milk, about $35 of this sum is used to keep the cow alive. That is fixed charges or the ration of maintenance. This ration of maintenance is practically the same whether the cow be a heavy producer or a low producer, as already pointed out. The high-producing cow is simply one that has a big capacity for using feed above what it costs to maintain herself. The proper feeding of cows in regard to amount is illustrated in the table which follows: —

TABLE 9. — *Rations.*

Full Ration.

Ration of Maintenance. Used for Milk Production.

a ———————————————— *b* ———————————————— *c*

Three-quarters Ration.

Ration of Maintenance. Available for Milk Production.

d ———————————————— *e* ———————— *f*

Half Ration.

Ration of Maintenance.

g ———————————————— *h*

The lines from *a* to *c* represent the ration for a heavy-producing cow, which is the one most liable to be underfed. The first half, from *a* to *b*, represents the amount of feed required to maintain the animal's body. The second half, from *b* to *c*, represents the portion of the feed used for the production of milk. In this case there is no fat being produced on the animal's body and the cow is supposed to have such dairy qualities that she uses all the feed she can digest for milk production.

The line below represents what would happen if the feed of this animal is reduced one-fourth. The ration of maintenance remains practically the same as in the first case. The amount represented by the line *d* to *e* is the amount required to maintain the animal's body, which is the same quantity as in the first case; however, the cut of one-fourth in the ration will be seen to come entirely on that available for milk production and reduces that amount one-half.

Suppose that the ration of such a cow will be still further reduced to one-half of the full ration, or that required for maintenance alone, as represented by the third line. In this case the cutting down of the ration one-half would remove all available feed for milk production. However, the animal would not cease producing milk at once. This is a point of great importance in feeding cows, and a lack of such knowledge leads to serious errors in feeding. The milk-producing function is so strong that the cow will continue to produce milk for some time, even when the feed is insufficient, utilizing the reserve material which has been accumulated in the body in the past. This always happens in the case of a heavy-milking cow during the first few weeks after the birth of a calf. At this time it is not generally possible, and not desirable on account of the condition of the animal, to feed her heavily enough to supply the nutrients necessary to produce the milk. Even if the feed were offered, the appetite is not usually strong enough to cause the necessary amount of feed to be taken to prevent loss in weight. As a rule, all heavy-milking cows decline in weight for the first two or three weeks, and occasionally for ten weeks, after calving, which means that the nutrients used for milk production have been in excess of the feed supplied for that purpose. The same thing happens in the case of a cow that is not fed a sufficient ration for the amount of milk she is producing. She may continue to produce considerable milk for a while by drawing on the reserve material of the body, but as soon as this is exhausted, the production of milk must come down to the amount available for this purpose, above the ration of maintenance. When the feed is in excess, the cow begins to store reserve material on her body. If the amount of milk produced by a cow varied directly with the feed, and she did not store up nutrients at one time and draw on reserve materials at another, it would simplify the problem of feeding very much and result in more economical feeding at all times.

How to avoid Overfeeding.

While the statement and illustration given applies to one class of dairy cows, there is another class to which it does not apply, and with which it would lead to a serious mistake in feeding from an economical standpoint. This group includes those of lower productive capacity which are liable to be overfed, especially when they are in the herds of dairymen who realize the necessity of liberal feeding. The proper feeding of this group of animals can perhaps be made clearer by the following illustration: —

Table 10. — *Cow of Lower Productive Capacity liable to be overfed.*

Full Ration.

Ration of Maintenance.	Used for Milk Production.	Body Fat.
a ———————— *b*	———— *c*	———— *d*

Economical Ration.

Ration of Maintenance.	Used for Milk Production.
a ———————— *b*	———— *c*

The line *a* to *d* represents the amount of feed that an animal of this class will consume; *a* to *b* represents the ration of maintenance as before. In this case, however, the capacity for making milk is not equal to the capacity of the animal for utilizing feed in excess of that required to maintain the body. The amount which the animal is capable of utilizing for milk production is represented by that portion of the line *b* to *c*, while the animal's appetite is equal to the total line *a* to *d*. This gives a surplus, *c* to *d*, which is not utilized for milk production, but which will be used for storing fat on the animal's body, and we will have the cow gaining in weight while she is producing milk. This gain in weight will be of no service so far as milk production is concerned, except that it is of some value as a reserve material to be drawn upon at some other time when feed is not supplied in sufficient amounts, and it is not economical nor desirable to fatten dairy animals with the expensive feeds which are fed dairy cows. That portion of the feed represented by the line *c* to *d* should be taken from the ration. This means reducing her feed to take off the amount used for storing fat on the body; in other words, feeding her only what she will utilize for milk production. This means feed enough to maintain a practically uniform body weight. In every large herd where the amount fed is not carefully regulated, we find errors made in both these classes. We find the heavy producing cows being underfed, and we find the light producing cows being overfed and allowed to accumulate fat.

Relation of Live Weight to Proper Feeding.

The live weight of a cow is a good index of whether the cow is being fed a proper amount or not, but good judgment must be used in regulating the ration by observing this condition. We must expect that a cow will lose weight in the first few weeks of her milking period, but after this period is past there is no reason why she need to change much in weight for several months, and this is the period when the greater part of the milk production is secured. It will not mean, of course, that the animal should not be allowed to gain in weight during the latter end of the milking period. This is necessary on account of the development of the fœtus, and since it is natural for the animal to carry some fat on her body at calving time.

It does mean, however, that in order to feed a herd of cows economically it will not do to feed them all the same quantity of grain, whether they are giving a gallon of milk a day or whether they are giving four gallons; and it means that when a cow in the middle of her lactation period is putting on weight she is being fed more than she needs, and will give just as much milk if the feed is cut down somewhat. It also means that if a certain animal is losing in weight, sufficient feed is not being given, and if the deficiency is not supplied, it will not be long before the milk production will come down to correspond with the amount of feed available.

Feeding as Individuals.

In connection with this subject of the amount to feed cows, it needs to be pointed out that it is only possible to feed a bunch of cows economically when they are fed as individuals, and not as a herd. A too common practice, even in the otherwise well-conducted herds, is for all animals to be fed the same amount of grain, regardless of the time they have been in milk or the quantity of milk individual cows are producing. Such feeding always lacks economy, as the high-producing cow does not get enough, and, while she may milk very well for a short time, she soon comes down to a lower level, while the lighter producing cow usually gets too much and accumulates fat.

One of the difficult problems which confronts the practical feeder is how to adjust the quantity of feed to meet these individual requirements. It can be done fairly well even in the large herds by observing how much milk the cow is producing, and whether she is gaining or losing in body weight.

Balanced Rations.

In the corn belt next to underfeeding the most common mistake in feeding is giving rations deficient in protein. This comes about from the abundance and relative cheapness of corn, corn silage or corn fodder, and the large amount of timothy hay grown. I assume that in New England, where it is the custom to purchase considerable feed, this error is not so common or serious as with the farmers in the corn belt.

Closely connected with this question is the one of growing legumes on the farm. We are constantly urging the Missouri farmers to grow more alfalfa, cowpea and clover hay. I hope New England dairy farmers already appreciate the importance of this subject and need no urging along this line. In my judgment successful and economical feeding of dairy cows must be based largely upon legume hay and corn silage. With plenty of home-grown alfalfa or clover hay on hand, it is an easy matter to plan a good ration for our cows and at the minimum expense for grain.

Succulent Feed.

In order that cows may do their best it is necessary that succulent feed in some form be provided. In some of the northern sections of our country, and especially in Europe, this desirable part of the ration is supplied in a very satisfactory state in the form of root crops. In the greater part of our country corn silage has taken the place of roots in the ration.

Corn silage supplies the succulent feed so desirable in order to keep the animals in the best possible condition. At the same time in most parts of the United States corn yields more food nutrients per acre than any other crop, with the possible exception of alfalfa in those regions where the latter flourishes.

Missouri has built over 8,000 silos during the past three years, and the progressive dairymen there would not think of doing without one. It will be but a few years until every farmer in the State will be provided with one. The use of silage is also growing with us as a summer feed to help out the pastures. It looks now as if the silo will in time supersede the soiling system almost entirely.

Mixed Feeds.

I presume the sale of mixed feeds is large in the State of Massachusetts, as it is in other places where much feed is sold. While I certainly do not condemn mixed feeds as a whole, I would especially caution every one to be on guard in purchasing them. I see no advantage in selecting them in preference to the straight feedstuffs, like corn, bran or cottonseed meal.

Mixed feeds must of necessity either sell higher than the same quantity of food ingredients in the unmixed form, or the mixed feed must contain some product that could not be sold alone. Every firm making a mixed feed has expenses to meet. They have advertising bills, traveling salesmen, a profit for themselves, and the handling of the feed once or twice in addition. As a matter of fact too often the chief reason for mixing feeds is to sell some product, oat hulls for example, that would not be salable alone. No feed dealer can make a mixture any better or any cheaper than a farmer who is properly informed regarding the feeding problem. In this respect, as well as many others, Massachusetts dairymen will do well to make use of the information supplied by the experiment station at Amherst.

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THE VALUE OF EXPERIMENTAL WORK FOR TRUCK FARMERS.

BY T. C. JOHNSON.

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THE VALUE OF EXPERIMENTAL WORK FOR TRUCK FARMERS.

T. C. JOHNSON, DIRECTOR, VIRGINIA TRUCK EXPERIMENT STATION, NORFOLK, VIRGINIA.

The work of the experiment stations has long been recognized as of great value to the fruit growers, dairymen, stockmen and general farmers, but the truck farmers have not, as a rule, received their full share of attention. There are two apparent reasons for this. The nature of the crops grown is such that they occupy the ground a comparatively short period, and they are usually followed by other crops in quick succession. This renders it very difficult to conduct successfully a series of fertilizer or disease-control experiments. Such experiments on orchards and grain crops of which the plants occupy the ground for a number of years, or the rotations are definitely worked out, are comparatively easy, but with short-season truck crops the problem is quite different. The ability to shift from one crop to another tends to develop the idea of solving the problems, or rather dodging them, by changing the cropping system. This, of course, is not practical with the orchardist or grain farmers.

The experiment stations have not received the demands for assistance from truck farmers that they have from the other classes of farm workers. Accordingly, they have responded to these urgent calls, and of necessity neglected the interests of the truck farmers.

But within the past few years there has been a noted increase in experimental work intended to benefit the truck farmers. This is especially notable in the States of Virginia, New York and Illinois, and the United States Department of Agriculture has, through its Department of Horticulture, been conducting investigations on several phases of truck farming.

There are several classes of truck-farm problems which should receive attention from the experiment stations. The Virginia Truck Experiment Station was established for the purpose of solving some of these for Virginia market gardeners, as is set forth in section 2 of the charter as follows: —

> *Object.* — It shall be the object of the station to conduct researches on the physiology of plants and the diseases to which they are subject, with remedies for same. In like manner investigations looking to the control and eradication of insect pests shall be undertaken. The comparative advantage of rotative cropping, the capacity of new plants for acclimatization, the improvement of varieties through plant breeding and selection, and the utility of manures, natural or artificial, shall all be considered with such other researches bearing directly on the interests of the truck growers of the State as may be deemed advisable.

Vegetable growers in general are interested in the problems pertaining to soil fertility, soil utility and soil sanitation. Also, they are concerned with plant breeding, especially in its relation to the improvement of varieties and the development of disease-resistant strains in fungous and bacterial diseases and methods of controlling them; in insect studies, including life histories and methods of control; and in general marketing problems.

Soil Fertility.

The work on soil fertility should include such topics as the use of natural and artificial manures, the kinds to use on certain crops, the method and time of making applications, and the quantities best suited. All these important factors are influenced by the crop rotation followed. When leguminous crops are to be turned under for soil improvement, smaller quantities of manures may be used; but if a certain class of legumes are grown for market purposes, the soil may be actually robbed of a portion of its available plant food. In a series of experiments conducted by the Virginia Truck Experiment Station it was found that the yield of a kale crop was greatly influenced by the crop previously grown in the rotation, as recorded in Bulletin No. 9. The different plats in the experiment were cropped and treated as follows, and then planted with kale in August, 1912: —

Plat 1 was planted to beans in April of 1908, 1909, 1910, 1911 and 1912, with millet following the beans in July, 1908, 1909, 1910 and 1911.

Plat 2 was planted to potatoes in March, 1908, 1909, 1910 and 1911, and crimson clover sown after the potatoes were dug each year. The crimson clover was turned under for potatoes in the early spring of 1909, 1910 and 1911, and worked into the ground during the summer of 1912.

Plat 3 was treated in all respects similar to plat 2, except that an application of 1,500 pounds of hydrated lime per acre was given before planting the potatoes in 1908, 1909, 1910 and 1911.

Plat 4 was given an application of 15 tons of well-rotted stable manure per acre before plowing for the potatoes in 1908, 1909, 1910 and 1911, and for the corn in 1912. The potatoes were planted in March, and followed by corn in July of each year. In 1912 the potatoes were omitted from the rotation, and corn planted in May. The stable manure was applied immediately before planting the corn.

Plat 5 was treated in all respects similar to plat 4, except an application of 1,500 pounds of hydrated lime was given per acre after the manure was turned under, and before the potatoes were planted in 1908, 1909, 1910 and 1911.

All plats received equal amounts of commercial fertilizer during the entire experiment.

Plat 1 produced 6,829.71 pounds of kale per acre.
Plat 2 produced 8,919.71 pounds of kale per acre.
Plat 3 produced 13,824.00 pounds of kale per acre.
Plat 4 produced 13,834.28 pounds of kale per acre.
Plat 5 produced 16,893.91 pounds of kale per acre.

Using the yield on plat 1, from which both the beans and millet were harvested, as the basis of comparison, the use of crimson clover in the rotation increased the yield 30.16 per cent, crimson clover and lime 102.4 per cent, stable manure 102.5 per cent, and stable manure and lime 145.9 per cent.

The work on artificial manure should include a study of the source of the various ingredients used. For instance, in our work in Virginia we have found that the nitrogen for certain crops grown in the winter or early spring should be obtained from one set of combinations, while for the same crop grown in the later summer a different combination is desirable. The form of phosphoric acid to be used depends quite as much upon the condition of the soil as upon the crop which is to receive it. There is still much work to be done on the various sources of potash best suited for the different crops in any line of agriculture. Where large quantities of commercial fertilizers are used, there are almost certain to be deleterious results. The residual effect of fertilizer has so modified the soil constituents that it is now practically impossible to grow certain crops where they formerly thrived. It is often seen that large quantities may be used under one system of cultivation with good results, while under another the result might be injurious. Two crops might require a fertilizer of the same quantitative analysis, but quite different in the ingredients from which the materials are obtained. For instance, tobacco prefers the potash from sulphate of potash, while on certain soils peanuts yield better if treated with muriate of potash.

There is still much room for the study of lime for use in connection with truck crops. We know in a general way what the results of lime are, but the application and interpretation of these results in specific cases is sometimes quite difficult. The Rhode Island Experiment Station has added very greatly to our knowledge of the use of lime with many of our truck crops, but the results obtained on the Rhode Island soils do not necessarily apply in all particulars to other types of soils. Under some conditions pulverized limestone may give excellent results; under others the results from it are negative; but those from freshly burned lime are quite marked. The kind and quantity of lime that may be used in connection with commercial fertilizer and stable manure also vary with the character of the soil. The soils of the Norfolk sandy loam type in the southern Atlantic States are prone to acidity in reaction. Consequently larger quantities of lime may be beneficially used on them in growing such crops as potatoes, strawberries and beets, but on soils which are alkaline in reaction the results are often injurious. The influence of fertilizer on the acidity of the soil is still open for investigation. Some investigators claim that it is practically impossible to increase the acidity by the use of commercial fertilizer. However, experiments conducted at the Virginia Truck Experiment Station seem to indicate that the acidity may be markedly increased by the use of certain fertilizer combinations.

Drainage and Irrigation.

The acidity of the soil is also influenced very largely by the drainage. It is frequently said by good truck farmers that if they were forced to choose between drainage and commercial fertilizer they would probably select drainage as the more important factor in crop production. The amount of drainage and the location and depth of drainage pipes are best determined by the local conditions. Drainage experiments conducted on one type of soil under certain conditions throw some light on the treatment under similar conditions; but if the conditions are different, it is best to make the experiment on the particular soil in question. It is well recognized that drainage has a marked influence on the availability of plant food added in the form of natural or artificial manures, but it is not so well known under just what conditions the plant may get the maximum quantity of these ingredients with the minimum loss by leaching. The effect of drainage on the relative earliness of market garden crops is obvious.

Irrigation should be studied in connection with drainage. It has been the general opinion that our irrigation problems were limited to the arid and semi-arid districts of the west, but we are now fast realizing the importance of an abundant and constant water supply for our eastern agriculture. The intensive truck farmer in the upper south would no sooner think of attempting to grow his crop without adequate drainage and irrigation facilities than without the use of stable manure or commercial fertilizer. The time, the quantity and the method of application are still fruitful subjects of investigation. We know that in a general way most of our truck crops should receive at least an inch of water per week, but there are some that will thrive better with one and one-half inches or even two inches, provided the drainage facilities are adequate. The ditch or furrow method of applying water has long been the standard in many sections of the country, but a few years ago the overhead system became quite popular. Now there seems to be a trend toward the furrow method under certain trucking conditions in the far south and the semi-arid west. There seems to be no definite data on these points which will enable the farmer to learn just which method he should use under his conditions. There is room here for a large amount of work.

Plant Breeding.

The work of the plant breeder in modern agriculture is almost as important as is that of the soil physicist. To the plant breeder we are indebted for the numerous adaptations of vegetables which have brought large remuneration to certain localities. For example, if only one kind of potato could be grown, many districts giving large acreage to that crop would be deprived of that industry.

Since there is great diversity of soil, climate and market conditions in the country, there arises great necessity for the development of characteristics adapted to use in the given surroundings. Accordingly, the plant breeder is devoting himself to this line of work and has produced some well-known results. The soil, climatic and cultural conditions in eastern Virginia require a class of spinach of the Savoy type, while under conditions prevailing in Louisiana the Savoy does not thrive so well as some of the thick-set or long-standing types. Market growers in the vicinity of Grand Rapids use the open-head or loose-leaf lettuce, while those in the Atlantic States grow some form of head lettuce. The plant breeders are at present busy making still further developments of these strains which have been adapted thus far to local conditions. Until a few years ago it was thought that tomato seed obtained from a typical individual of a variety would give the best results possible, but now it is known that in addition to being from a typical plant it is best to pollinate the flowers with pollen from another plant of the same variety, thus infusing new blood into the combination. By specialized breeding the cucumber has been adapted to the cultural method of the open field, the cold frame and the greenhouse.

The truck farmers in the south have long since learned that the potatoes of the Bliss type may be grown in Florida, Texas and Louisiana with a profit, but that in the Carolinas and Virginia the Cobbler type is more popular, and in Long Island other types come nearer meeting the requirements. The early Ohio is popular in the middle western States, but in the south Atlantic it is held in poor esteem. Thus it appears that potato growers in the best producing centers have learned to depend on certain varieties of seed adapted to their special interests. After securing a variety desirable for a given locality, the plant breeder has open before him a large opportunity for developing strains resistant to disease and unfavorable environment. The Crosby Egyptian beets, now used to a large extent in Massachusetts, are favorites with the Virginia truckers for their early spring crop, but the Egyptian beets are preferred for the late summer and fall crops.

The laws governing the transmission of characteristics in breeding are fruitful sources of study. The work done in this line by a number of the experiment stations in both American and European countries is fast becoming of great value to truck farmers.

Plant Diseases.

The experiment stations have devoted a great deal of time and energy in the last twenty years to studying the causes of plant diseases and the remedies for them, yet in some lines of agriculture this work has hardly started. The study should now be devoted to discovering the causes underlying the diseases of plants. In some trucking sections the excessive use of commercial fertilizer, together with the intensive methods of cultivation, have rendered conditions favorable for the development of certain classes of diseases that otherwise would not be likely to occur. The study of the exact conditions making it possible for the disease to develop should be undertaken. After this discovery the application of remedies may be much simplified.

The life history of the organism causing certain diseases should receive careful study. It is important to know the life cycle of the organism in order to combat the specific disease. If the market gardener wishes to maintain the health of his plants, it is as important for him to keep his plantation in a sanitary condition as for him to treat the diseases after they make their appearance. But in order that he may do this intelligently, the scientist should be in a position to give him the full life history of the organism causing the trouble. He should know where the organism spends its time when not on the plant in question. It frequently happens that diseases may be introduced into new localities on the seed. A marked case of this kind was encountered in eastern Virginia in the spring of 1911. A large grower of plants purchased cabbage seed from a certain seed concern and planted them for the purpose of growing plants for his neighbors. He supplied about two million plants to the different truckers. Within a few weeks phoma wilt appeared in all the fields where plants from this particular lot were used, the loss resulting in from 50 per cent to 90 per cent of the crop. The man who grew the plants was guilty of negligence, and the man who used them was innocent; but if the plant grower had followed the instruction given by the experiment station, the disease need not have been introduced.

Some diseases may be controlled by soil treatments. That is, the soil may be rendered favorable or unfavorable for their development by the treatment given it. This is especially true with some forms of bacterial and fungous diseases. In other instances, the disease may be controlled by treating the seeds or the vegetative portion of the plants used for propagation.

The Virginia Truck Experiment Station in co-operation with the Maine Experiment Station has been conducting a series of investigations looking to the control and eradication of the "black-leg" disease formerly prevalent in some potatoes brought from the north and planted in the south. This work has resulted in developing practical means of eliminating the trouble by selection of the seed potatoes in the fields in the north.

At the present time the preventive measures are much more important than are the curative. Blight can be controlled in the potatoes by spraying with fungicides before the disease makes its appearance, but if once established in the plants, the problem of eradicating it is quite difficult.

The experiment stations frequently outline modifications in methods of culture that will largely control a number of the more malignant diseases.

Truck Crop Insects.

It has long been known that such insects as the Colorado potato beetle and the codling moth can be controlled by the application of arsenical poisons, but with aphides and numerous other insects it is important to know their life histories in order to combat them successfully. The truck farmer can apply the remedies, but the investigator should work out the life histories in order to know when best to make the application. Recent studies conducted at the Virginia Truck Experiment Station show that the pea aphis spends a great deal of its time while not on peas on clovers and similar plants which are green throughout the mild winters. Consequently, a large number of insects are in waiting when the peas make their appearance in the early spring. A knowledge of this fact serves to caution the trucker not to grow peas and clover in close proximity.

The feeding and migratory habits of the insect should be studied carefully. The larvæ of the fig beetle in the south has the obnoxious habit of feeding on organic matter contained in very rich, sandy soils. Their burrows in the soil are sometimes so numerous that such a crop as parsley may be practically ruined. The insects have the habit of coming to the surface of the ground at night and crawling from place to place. A knowledge of this habit enables the truck farmer to trap them in open ditches.

By the omission of crops in rotation which furnish hibernating places, or by the intelligent disposition of the refuse left after harvesting, the injury from other classes of insects may be greatly reduced.

Marketing Problems.

The various phases of harvesting and marketing are fruitful fields for investigation. Refrigeration in transit and pre-cooling for long shipments are receiving the attention of the fruit growers, but very few experimental shipments of vegetables have been undertaken. This question is interstate in its character. Consequently, it should be undertaken by the Federal Department of Agriculture, or by different experiment stations as a co-operative project.

Systems of cost accounting are receiving careful attention by the various farm management departments, but the questions involved in proper marketing of garden products are receiving but little consideration. The matter of distribution is of much importance. It frequently happens that vegetables will be selling very low in one neighborhood and high in another only a few miles distant on account of the poor methods of distribution. This feature should receive attention by the departments of agricultural economics.

Mr. H. F. Arnold. I wonder if it would be out of place for Professor Johnson to tell us what the trouble was that he spoke of with those cabbages, and what the remedy was that he applied to that trouble.

Professor Johnson. It was a form of wilt which was overcome by treating the seed with a formaldehyde solution. Treatment in that way would have effectively prevented that. It was a disease that was brought in with the seed. The Ohio Experiment Station and Federal Department of Agriculture both published bulletins on that proposition.

Question. I would like to ask the professor if he has found, in his experience, any difference in the keeping qualities of vegetables raised by irrigation.

Professor Johnson. Not in my personal experience. In the west the farmers claim to have produced a better grade of vegetables by irrigation, but they have a tendency to be a little softer. But the quantity and the grade are so much better that they counteract any negative results.

Mr. Howard. In regard to that disease in potatoes, how did that affect the potatoes?

Professor Johnson. The disease makes its appearance on the young potato plant when it is 6 to 12 or 15 inches tall. It causes a blackening of the stem first, which runs down to the tuber, the stem topples over and the tuber rots. This disease has the fortunate habit of not carrying over in the soil, so that it is a very easy disease to control.

Mr. Lewis. I would like to ask the speaker if he can give us any information on the melon blight or cucumber wilt.

Professor Johnson. There are two or three of those blights.

Now, we have in the far south a bacterial wilt which I don't believe you have in this State. Then we have some of those fungous diseases which cause trouble. With the bacterial wilt it is a question of proper rotation to get that out of the soil. Of course, in the bacterial wilt we have to go a step further and not reinfest the field by using manure composed of the decayed vegetables that have had this bacterial wilt. In a lot of our work we have done spraying on cucumbers and have used the Bordeaux mixture. If we can get one composed of a small amount of copper sulphate and a small amount of lime, and have a good pressure, we can get good results. If we use a 5-5-50 Bordeaux and apply with a low pressure pump our results are sure to be negative. But where we use a 6-6-50 Bordeaux and apply it under 100 or 125 pounds' pressure, and arrange the nozzles of the pump so that we can get under the inside of the foliage, we have been able to hold up the cucumbers for weeks.

Mr. H. F. TOMPSON. I would like to ask Professor JOHNSON about the apparatus that is used for applying the Bordeaux mixture.

Professor JOHNSON. We have not been able to buy a satisfactory machine on the market for that purpose. There are several types of spraying machines that are used, any of which give good high pressure, but they are usually two-gear machines, geared to wheels. We use them so as to have three nozzles play on a row of cucumbers, two nozzles set so as to play in at an angle, and a third one to play on the top of the row. And we arrange those so as to spray two rows of cucumbers each time the machine goes across the field. Some of our farmers have spray pumps that will hold up a hundred pounds of pressure under nine nozzles,—these large type of nozzles. Where they use nine nozzles it usually takes about 125 gallons of liquid to spray an acre of ground, and we have to have spray pumps that will sustain 125 pounds' pressure.

QUESTION. How early is that spraying done?

Professor JOHNSON. The spraying is usually started when the vines are 16 or 20 to 24 inches long. I don't like to wait after 24 inches, and don't start before 16. The spraying has a slight tendency to delay the first setting of the cucumbers, that is, it keeps the vines green and vigorous. In this spraying we usually find it advisable to train the vines on the rows so that we will get through the vines.

QUESTION. I would like to ask the speaker if he thinks melon blight is caused by weather conditions or insects.

Professor JOHNSON. Neither one. The weather conditions may be favorable for the development of it, but the melon blight is either a fungous or bacterial disease. The insect comes in when you have a bacterial disease, and the insect sucks the juice out of the plant, and it may be carried out to other plants. The insect may be either of the flea-beetle type or the striped cucumber type or another type the name of which escapes me for the moment. The control of insects plays a large part in the control of the distribution of plant diseases, the insect getting the plant diseases on its body and carrying them to other plants. We have had all that demonstrated recently by the typhoid germ being carried by the fly.

Mr. HIGGENBOTHAM. What is it that attacks the small plants just as the seed leaves are coming out? On the cucumber the leaves seem to curl up and turn yellow.

Professor JOHNSON. There is a small beetle that looks something like the flea beetle. It is not the flea beetle, but from ordinary appearance it might be taken for one. Those insects jump off and go on the ground. Now, one of the best remedies we have found for them — not a remedy, after all, but only a means of driving them away — is by applying raw fish scrap, — dried ground fish scrap. Do not take fish scrap that has been treated with phosphoric acid, but take the ordinary fish scrap. You can put that right on top of the cucumber plant as it comes through the ground and it will drive them away. It does not kill them.

Mr. GEORGE W. TRULL. Did I understand you to say how many times you spray for blight?

Professor JOHNSON. We usually spray cucumbers about every ten days or two weeks, depending on weather conditions, making the first application when the vines are 16 to 20 inches long. If we have dry weather it is not necessary to spray more than every two weeks, but if the weather happens to be a little cloudy or with some rain, and the vines are making a rapid growth, we prefer to make the sprayings not over ten days apart, and to make four or five sprayings a season.

Mr. Howard. I would like to ask Professor Johnson what support he has received from the truck farmers? How do they take to these experiments?

Professor Johnson. Our truck farmers in eastern Virginia, to use a slang expression, decided some eight or nine years ago that they were up against a hard proposition, so to show their faith in the work they got together and bought a farm and then went down in their pockets. In addition to buying that farm, they paid out $7,500 in cash for buildings on the farm, and then they turned around and leased that to the State for ten years without rent and renewable at the option of the State. In other words, they turned it over to the State and asked the State to come in and run that work. The State took up the proposition and has made the appropriations and has continued the work. Now, every time that our experiment station wants anything from our Legislature the first thing we do is to go to the truck farmers and get a good committee from them, and then we go to the Legislature and we usually get some money. The value of that property that the truck farmers have put into the work is to-day $25,000; that is, if the State should vacate the property the farmers could sell out for $25,000 or $30,000, but they are perfectly willing to let it go on, and in addition make frequent contributions for certain improvements or investments.

Question. I would like to ask, what are the features of the organization?

Professor Johnson. There are two organizations in eastern Virginia that are back of it. The one that fathered the movement was the Southern Produce Company. It is a co-operative trucking organization at Norfolk. The other organization is the Eastern Shore of Virginia Produce Exchange. As I understand it, the Southern Produce Company did not ask the Eastern Shore Produce Exchange to help at the time the project was started, but after that the Eastern Shore Produce Exchange came in, so that those two organizations are behind the work, and the work is supported by them. The Southern Produce Company is an organization in eastern Virginia of 400 members, and it does $2,500,000 worth of business. The other is an organization of about 1,500 members, and their secretary and treasurer told me the other day that their business for this year amounted to a little over $5,500,000. I might say in that connection that practically every State that has taken up this work has taken it up with the hearty co-operation of the people who are interested in it. Market growers or vegetable growers or truck farmers, — by whatever name you call them — must get behind the proposition to make the proposition fairly successful if they want to get the benefit of it.

Mr. Howard. Professor Johnson spoke about malnutrition in regard to raising a spinach crop. I would state here that we have had a good deal of trouble with the spinach yellowing at times in the fall, and at times in the midsummer. Can you give us any information on that?

Professor Johnson. That is one of the troubles we are working on now, and have been working on for the last two or three years. That yellowing of the plant is one of the hardest propositions we have had to meet in our spinach troubles. We have done this: wherever we have used the wide rotation and used a good deal of lime we have not had much trouble; where we have used close rotation and neglected to use the lime we have had a good deal of trouble.

Question. Do you have mold on the spinach?

Professor Johnson. We have done some work on spraying spinach when it was young, but of course you understand there would be objection to spraying spinach with Bordeaux mixture. Mold has not proven very detrimental to us yet. We have it in some of our fields. It is largely a question of cleaning the fields and preventing the introduction of the disease from other fields or from other sources where the disease may be spending some of its time. There is a question again of plantation sanitation, as we might put it.

Mr. Howard. I think there are a number of truck farmers here, and market gardeners around Worcester and Boston who are present at this meeting. We certainly have troubles enough in regard to producing good crops. One of our big problems has been the looking after sanitation in the soil, — to keep the rubbish out of it. I would like to get Mr. Hittinger to say a few words in regard to what he has accomplished in that line.

Mr. HITTINGER. I don't just understand what you mean. In the greenhouse or out of doors?

Mr. HOWARD. In regard to the greenhouse work, because you have got rid of so much of the lettuce rot.

Mr. HITTINGER. That is done by keeping the ground cleaned up; keeping the old stuff out of the soil there; not putting it into the manure. I will state what we do to the old refuse that is left from our outdoor crops. I generally clean it up and form it into a pile and make a compost heap out of it; take some coal ashes and then mix it in and put manure with it, and put it on some of our lighter soils, and it seems to work all right there. I notice when you leave it in the soil there you are apt to have more trouble. In the greenhouses we generally keep that stuff all cleaned up. Now, we have never sterilized in our greenhouses, and by doing that we avoid sterilizing any houses. I would like to ask one thing: if you don't find that yellow comes after you manure a piece of ground in the fall, then why do you plant spinach where it has never been manured?

Professor JOHNSON. We have been able to control that best on our soil where we have plowed under a crop of cow peas. We find that trouble has not been caused by the application of manure; in fact, we have been able to control it largely by the application of manure, that is, we have added to the vigor of the plant so much that it has been able to withstand those troubles.

Mr. ARNOLD. I would like to start a little bit of discussion here, — in fact, to get the opinion of some of you other people about that question which has been brought up about the refuse crop. We have had a little discussion at home between myself and my brothers on the subject. On a trip recently to the market gardeners we stopped at Long Island on the farm of Mr. VanSuclin there, and I noticed he spoke of being very careful to clean up the refuse of all crops. — carrot tops, beet tops, anything of that kind, — to clean them off the land. It has always been our practice at home to plow in that kind of stuff. What do you do with celery trimmings? We take ours out and plow them into the land; we believed there must be some value in them. As far as the question of disease is concerned, will the disease of the celery carry over the winter in the land that is outdoors? I would like to get some opinions on this question. It seems to me the best we can do with that stuff is to plow it in. We pay money for refuse straw that has been used as litter under a horse, and I can't see any difference in that and good healthy celery, or with some few spots on it, carrot tops or beet tops, or anything of that kind.

Mr. TRULL. I was in Lawrence only a short time ago, and a druggist said to me, "What are you farmers all buying so much formaldehyde for?" I said, "I don't know; is that a fact?" "Yes," he said. I told him what I wanted of it. Now, can you tell me how we should use it and what it is good for?

Professor JOHNSON. Formaldehyde is used for several things by the farmer. It is especially used in treating potatoes that have scab for the prevention of the spread of the scab in potatoes another year. It is also used by the farmers of the west in treating wheat for smut. It is used in treating a number of seeds to cleanse them of germs of disease that may be carried over on the seed.

QUESTION. Tell us, please, how you treat them.

Professor JOHNSON. In treating wheat we usually make a solution of 1 pint of formaldehyde to 30 gallons of water, and then spread the wheat down on a canvas and spread it out so that it is a few inches thick, and moisten it with this solution, — the water and the formaldehyde solution, — and allow it to stand a little while before the wheat is sown. In treating potatoes we make a solution of 1 pint of formaldehyde to 30 gallons of water, and dip the potatoes into that solution for two hours, take them out, allow them to drain and dry, and then go out and plant them.

QUESTION. Will you tell us what kind of formaldehyde to ask for when you go to the store to buy it? In one case I sent a man to a store to get it and he got something else.

Professor JOHNSON. We use 40 per cent commercial. What is the price of it here? I know what we pay for it in hundred-pound carboys.

A VOICE. About 20 or 25 cents a pound. They charge 75 cents for a pound of chemically pure.

Professor JOHNSON. A person ought to buy the material in large quantities — 100 or 200 pound lots — at 9 to 12 cents a pound. A pound is a little less than a pint.

Mr. Howard. I would like to ask Professor Johnson what he requires of these farmers in cleanliness in regard to diseased crops. When they have diseased crops, does he allow them to plow the latter into the ground, or does he recommend them to clean up the land?

Mr. Johnson. Most of the farmers follow the practice of cleaning up. Most of them, if they have any disease appear in the lettuce, will remove not only the head of lettuce but the soil around the head. This is especially true when the lettuce has lettuce droop. The head will be removed and burned in the furnace, or taken away where it will not get back into the soil. The question came just now about leaving the lettuce on the ground. There is another problem comes in which is rather important to the southern grower, that is, in growing our spinach we will harvest it in November to March or April. Now, if we harvest a crop of spinach in March and expect to follow that crop of spinach with snap beans we are going to have trouble on our hands right off and our trouble comes in a way you would hardly expect. There is a little black fly that deposits eggs on the refuse spinach that is left on the ground. If we turn them into the ground we will have the finest crop of root maggots you ever saw. Those flies deposit their eggs on the leaf, and the decaying leaf goes into the ground. It practically insures your not getting the beans. If we turn that spinach under and leave it under for thirty to forty-five days before we plant the beans we are not troubled. Further, we have found in our work that if we plow under a diseased crop of cucumbers we are almost sure, — if we follow immediately with cucumbers, or within twelve months, — we are almost sure to have the disease worse in our cucumbers than if we had not plowed under the disease at the time. So that I would emphasize that. The question of sanitation is really a very important question in the control of our market-garden diseases.

Mr. Brown. That question is one that has interested me a good deal. I was present in a market gardener's meeting recently, and one man said to me that if he had his way he would clean up his celery fields absolutely, if it wouldn't cost him much money. In my own case this last year I planted celery on a tract of land where I had blight last year, and again this year. A friend of mine who was in the business in 1913 had bad blight in his celery, and in 1914 planted the land with celery and had the best crop he had ever raised. I can't explain it and I don't believe you can. I can't tell whether that blight is carried over in the soil or not. In my experience I should say it was perfectly positive it was so; but I go to my friend who did the same that I did and he had not a bit of trouble.

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THE ENCOURAGEMENT OF CLEAN MILK PRODUCTION.

By L. B. Cook.

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THE ENCOURAGEMENT OF CLEAN MILK PRODUCTION.

L. B. COOK, MILK SPECIALIST, UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, DISTRICT OF COLUMBIA.

If the dairy farmers of this country were asked this question, "What can be done to encourage the production of clean milk?" I am sure that nearly all would answer, "Secure better prices and markets for our product." Therefore, the conditions as they exist to-day are these: many dairymen do not receive enough for their product to warrant any extensive changes or outlay, and many dairymen who are paying no particular attention to better milk are receiving the same price for their milk as those who are trying to market a clean, safe product. This state of affairs, one can readily see, does not encourage clean milk production; however, we must work with the facts as they are. If we expect the farmers to produce better milk, we must assist them to receive a reasonable profit for their labor.

In some sections of this country, dairymen state that the price received for milk is not sufficient to warrant their staying in the business. If it were not for the value the cows are to the farm, more dairymen would stop milking them, and take up some other line of agriculture. The question of prices and profit is a problem which we must meet, but one which cannot be quickly solved. While we are adjusting this problem, we must meet the conditions as they exist with many dairymen, and encourage them to the possibilities that are now before them.

The United States census shows that the number of dairy cows per 100 population is slightly decreasing; probably part of this loss is covered by the increased production. The price of milk during a period of years has been increasing slightly, but nothing in proportion to the rise of prices for other foodstuffs. This increase has not been sufficient to meet the increased cost of production.

Improved sanitation means more cost to produce; therefore, when we are working with farmers who are receiving a low price for milk, we must act with reason. No one will deny that in many cases the farmers are receiving little compensation for milking cows; however, I believe with existing prices it is possible for the dairymen of this country to obtain more profit and produce better milk.

It is claimed that only about one-third of the dairy cows in New York State are kept at a profit. If this is true of New York, it is probably true of many other States. As I visit the dairymen of this country, I am impressed with the statements that they make in regard to the amount of milk received per cow. Some dairymen say their cows are averaging about one gallon each, while others say theirs give three. Why this difference? There are several things that might assist in this condition of affairs, yet I believe it is principally accounted for by the difference in cows. A profitable cow costs little more to keep than an unprofitable one; yet farmer after farmer is keeping these scrub cows. It is also a question of the dairyman not really knowing which are his profitable cows and which the boarders. Too many think they have no time for the Babcock test and the scales. If dairymen are to produce milk on an economical basis, they must start with better cows. Then they must properly care and feed these cows if best results are to be obtained. Successful dairymen are using silos, growing alfalfa, etc.; therefore other farmers should study these matters.

Again, as one travels over this country, he cannot help being impressed with the many kinds of waste that are continually occurring on our farms. The farm machinery that should last a number of years is allowed to deteriorate rapidly because it is not properly housed and cared for. One of the most valuable assets to the farm, namely, the liquid manure, is allowed to waste by soaking into the ground near the barn. Even the solid manure is thrown under the eaves, and the soluble elements, which are the best form of plant food, are allowed to be lost. So we might mention loss after loss that is continually occurring on our farms, mainly because of poor management. I can hardly see how the dairyman can expect the consumer to pay for such losses; yet that is really what he wants when he allows these conditions to exist, and cries for better prices.

Now, why is it that these unprofitable practices are continuing? One reason is that no one has told the farmers differently, and here is a real opportunity for the milk inspectors of this country. The inspector should act as an educator to these farmers, and assist them to see their mistakes. I am afraid we inspectors do not spend time enough on the farms and with the farmers, but try to cover too many places in a day.

Dairymen must be shown the value of keeping books. No business firm, with capital equal to the value of a farm, would think of conducting its business without books. Dairymen must know where their losses and gains are, otherwise, at the end of the year, they will not know definitely whether they have gained or lost. In nearly all hearings on the cost of milk production, the farmers have been hampered by lack of definite figures. It is not sufficient merely to say, "Milk costs me more to produce than I get for it." Until dairymen realize this fact, I believe they are going to be hampered in their fight for better prices.

On the other hand, we should encourage the producer by trying to educate the consumer to the value of milk. During these times of high cost of living, it is very opportune that consumers appreciate the food and economic value of milk. I believe that most people should use more milk, and that many do not realize its cheapness as a food, even if it costs 10 cents a quart. It is surprising how quickly consumers are ready to stop using milk, when there is a rise of 1 cent a quart, yet make little complaint when beefsteak rises several cents a pound. Also, they must be educated to the fact that clean, safe milk costs more to produce and therefore they should expect to pay more. Until consumers are willing to pay a reasonable price for milk, and appreciate quality, it is a question in my mind whether the farmers' prices can be increased, and the inspectors accomplish the results they would like.

Milk inspectors in their work must bear in mind that city consumers need and must have milk; therefore their work among the dairymen should be constructive and not destructive.

I believe the ideal inspector has two lines of work to accomplish; one, to protect the consumer, and the other, to assist the milkman.

Inspectors can do much good by assisting the dairyman to keep in touch with the available literature on different phases of dairying. The successful dairyman must be a business man, that is, one who has knowledge and applies it. Our federal, State and college departments are continually publishing literature which should be in the hands of the milk producer, yet it is surprising how few avail themselves of this free information; possibly, they do not know of these bulletins; if not, inspectors should help to keep them informed. I believe no successful dairyman can afford to be without a dairy paper. By reading and studying he becomes encouraged to produce better milk, and will know how to secure more profit from his business.

On the point of producing better milk there is much need of education. Dairymen must be educated to the value of clean milk. Large sums of money are lost annually because good milk is allowed to spoil. It needs to be said with emphasis that it is to the interest of every producer to have the best milk possible; such milk is always worth more than that carelessly produced, for whatever purpose it is to be used.

Our main standard for quality is the bacteria count, yet dairymen as a rule know little about bacteria. How many farmers know what bacteria are, where they come from, and what they do? Possibly, they have heard something about their dangers, but nothing about their value. Much education is needed on the sources of bacteria and how their numbers can be controlled. The bacteria problem, as now impressed on the minds of many dairymen, is a factor of discouragement, and a problem which they do not know how to handle. They need encouragement and education on this subject.

Good, clean, safe milk can be produced with a minimum of expensive equipment. Why not encourage the dairyman to improve quality by asking him to do two or three essential things, rather than discourage him by telling him a multitude of requirements? I believe more energy should be spent on a few essentials, instead of giving the dairyman the idea that it is necessary for him to go to considerable expense in order to produce clean, safe milk.

The less the expense and the smaller the number of requirements we have for the production of clean milk, the quicker results we are going to obtain. We must always bear in mind that the dairyman is in the business to make a profit, and we should assist him to this end. If we can help him to solve some of his financial problems, the question of quality will be easier to handle. For example, the covered pail costs very little more than an open pail, yet the results for clean milk are wonderful. It is claimed that this one factor under ordinary farm conditions will exclude about 90 per cent. of the dirt. The use of the damp cloth takes only a little time, yet it is one of the important factors for clean milk production.

It is encouraging to note that some of the large dairy companies are paying a premium for milk of a high sanitary standard as well as for a fat content. This, surely, should be an incentive for dairymen to produce better milk.

The grading of milk as now done in some cities and one State ought to be a move in the direction of encouraging the farmer to produce better milk. No one ought to be satisfied with his product when it is sold as grade C and at a lower price than grade A or B.

Certified milk, as you all know, sells for more than ordinary milk because it is recognized as something of better quality. It is only a question of a short time when quality in milk must be recognized, the same as with other commodities. We have made some progress already. The problem of encouraging farmers in this manner rests partly on our city milk inspectors, who should act as educators and not entirely as law enforcers. They must put themselves in the dairyman's place, give him their time and thought, then I am sure results will be forthcoming.

Co-operation and a feeling of friendliness and good will should exist between health departments and dairymen. The farmers should be encouraged to feel that the health department and the inspectors are not only for the purpose of protecting the city consumers but also of assisting them.

One way of promoting this good feeling is by holding meetings at some convenient place, like the country schoolhouse. At these meetings the dairymen should be encouraged to feel that it is their meeting, that questions and discussions are expected. Such meetings are being held by the inspectors of some cities, and are a decided success.

Another method of assisting the dairyman is by milk contests in which good prizes are offered. With these contests are usually held meetings that are of value to the dairymen, and in these contests I think more good can be done the contestants if good, practical prizes are offered; for example, give pure-bred stock, covered milk pails, separators, etc. Education should be the main purpose of such contests.

At a recent milk contest, the results of which were based on the average of four samples taken at random from cans as delivered in the city, I had the pleasure of meeting the gentleman who won first prize. In conversation he told me that he was then receiving about 19 cents a gallon for his milk, which was more than was received by any other producer sending to the same dairy company. Later I learned that in the preceding year, which was his first time in a contest, he won a prize and was at that time receiving about 17 cents a gallon for his milk. His score the first year was 89.4 per cent. and this year 95.8 per cent. This shows that the contest had been of considerable educational value to him and that he had profited financially, not only from the prize money, which amounted to $45, but, also, he received more for his milk throughout the year.

If results are to be accomplished, the inspector must spend considerable time with the dairyman and not hurriedly try to cover his territory. If this is done, it will mean that there must be more inspectors and more money for this work; yet is not this what must be done if results are to be accomplished? And results are what we want.

I do not believe that as good results can be accomplished by force. You might make a dairyman use a covered pail, but if he has to use it against his wishes, he is not apt to use it when the inspector is not there, while on the other hand, if he is educated to the value of the covered pail, he appreciates the necessity for using it regularly.

The dairyman must be encouraged by our assistance. We must take an interest in his views, and help him to overcome his problems. Nearly every farmer can receive more profit from his dairy if he will use business methods; that is, have better cows, practice better breeding, feed wisely, grow alfalfa, use a silo, etc. He can produce better milk by using a covered pail, by wiping the udder with a damp cloth, by more attention to washing and scalding utensils, and by better cooling.

We, as inspectors, should not only call the dairyman's attention to his poor equipment and methods, but should encourage him by offering suggestions as to how he can, with the least expense and trouble, correct his shortcomings.

We do not want these dairymen to go out of business; therefore, we must assist them to more economical practices, so they can derive a better profit from their business; we want also to educate them to the value of clean milk and the essentials necessary to make such a product.

The main milk problem is not what we can get a few dairymen to do, but what we can assist the majority to do. What are we going to do with the tenant farmer, or one who does not have the means to build new barns, etc.? This is the question which we must answer, and I believe it can be accomplished only by education. What we want is clean, safe milk; the poorly equipped farmer can produce this kind of milk if he only knows the essentials necessary. It is a question of encouraging and not discouraging. As a rule there is no surplus milk in our cities; therefore let us work with the idea of encouraging the dairymen to produce more and better milk.

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A PRACTICAL SYSTEM OF FARM BOOKKEEPING.

BY CHARLOTTE P. GODDARD.

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A PRACTICAL SYSTEM OF FARM BOOKKEEPING.

MISS CHARLOTTE P. GODDARD, SARATOGA, NEW YORK.

It seems to me that no up-to-date farmer in these days would question the value of a good system of bookkeeping; no such farmer, if his farm is bringing him in a good profit, but would be glad to know just where his best profit is, or, in case there is little or no profit, to know where the leakage is. But how to bring it about is often a difficult problem. His day's work is a long one, often twelve, fourteen, or even more hours. He does not feel like sitting down at his desk at the *end* of such a day, and to stop *during* the day is impossible. Oftentimes that sort of work is distasteful to him, which makes it doubly difficult. On the other hand, to employ a bookkeeper is out of the question, not only on account of the expense, but because there would not be enough work to keep one employed all the time. If he is fortunate enough to have a wife or daughter who *can* do this work, and who has the time as well, then his problem is solved; but usually, even though she may be capable of doing the work, she has duties of her own which require all her time. My suggestion, as a solution of this problem, is that several farmers get together, as they are beginning to do in other lines, and employ a bookkeeper co-operatively. For the past three years it has been my great pleasure to serve one community in this capacity, and I know that the people for whom I have been doing this work will agree with me that the plan has worked splendidly.

My work as a co-operative bookkeeper is the result of the fact that several people in one community felt the need of some one with a knowledge of bookkeeping and cost accounting who would come in and handle their accounts, and whom they did not need to employ for the whole time, as each one needed a bookkeeper only a few days of every month. By co-operating in this matter, they arranged with me to do their work, going from one to another in regular rotation. In this way I have been able to give each one all the time necessary for the work, delegating, in each case, to the man in charge, the keeping of such records as must be made daily. Everything in the way of bookkeeping which could wait until my return was left for me to do, — the making out of all bills, the balancing of the books, the analysis of the bills to be paid, the keeping of all permanent records, and so forth. In this way the coming of the bookkeeper became not a burden, but more and more a help.

In order to show you how it is possible to keep up a system of bookkeeping in this way, and how practical it really is, I will endeavor to describe, in a general way, the system which I have used.

Of the records which the farmer himself must keep, the most important is, of course, a cash book. It is imperative that we have a careful record of every item of expense or receipt, large or small, whether a check or a cash transaction. Such records must necessarily be made daily, so that the care of them devolves on the farmer himself. The balancing of this cash book may, however, be left for the bookkeeper. She might even relieve the farmer of the task of balancing his check book, if he did not care to bother with it himself.

Right here let me say that I hope every farmer *does* have a bank account and *does* pay all his bills by check. I have been surprised to find how many people there are who do not make use of such an institution as the bank. I know of a man who had been in business for himself for years, with good success, who is now the efficient manager of a farm, but who says that never, until within a year, did he do business with any bank. He told me that many times he had had several thousand dollars in cash in his home, hidden under rugs, and so forth; and when I asked him what happened on sweeping day, he replied that his wife took good care of it, that none was ever lost. Would any of you think of mowing a ten-acre field of oats with a scythe when there was a good mowing machine in your own barn? Of course not. Neither, I hope, would any of you think of keeping any quantity of money in your home when there is an institution in your own town which can take better care of your money for you than you can yourself.

To return to our accounts. Aside from the cash book there are a few other records which must be kept up daily, in order to give the bookkeeper all the data she needs. Whenever any article of any kind is sold, some record must be made of it. This can best be done by the use of duplicate slips, similar to those used in our grocery and provision stores. By the use of these a carbon copy is made of every slip. One copy goes to the purchaser, the other is kept for the bookkeeper. From all these slips accumulated during the month she makes out the bills. This is a very simple and safe way to keep these items, and the books are very inexpensive.

The farmer ought also to keep some sort of memoranda of all purchases made, so that when the dealer presents his bill at the end of the month, he or the bookkeeper may be able to check up every item of that bill. In most cases he will receive a slip with each purchase, so that he has merely to keep these together carefully.

The milk record, feed record, and labor record, if kept at all, must necessarily be kept from day to day. I shall refer to these in more detail later.

So much for the farmer's part in this bookkeeping. This certainly is not difficult, nor does it require much time, and it is even simpler than it sounds. And the fact that it *is* simple should recommend it to you, for, next to accuracy, it seems to me that simplicity is the most important quality of a system of farm accounting. By simplicity I do not mean that it shall be any less complete than any well-kept set of books anywhere, but it shall be such that any desired fact may be easily available in the books; that there may be the least possible crossing of accounts from one book to another; that the time which the farmer himself must spend on them shall be kept at a minimum; and that, above everything else, the books, at any time, shall be perfectly intelligible to the farmer himself.

Aside from the cash book, which is to be kept by the farmer, two other books, kept entirely by the bookkeeper, will be indispensable. The first is what I have called a bill book, which takes the place of a customer's ledger. When the bills are made out, each one is entered in this bill book before being sent out. The name of the purchaser, with the amount of the bill and the total amount of each sort of article purchased, is all that need be entered. For example, Mrs. Brown purchased goods to the amount of $15, of which $5 was for butter, $4.50 for eggs, $3 for milk and $2.50 for cream. Mrs. Smith's bill amounted to $10, all of which was for butter; and so on down through the list. Besides entering all new bills, any of the preceding months' bills, which may be still unpaid, are also listed, so that this book, then, always shows what the accounts receivable are on the first of each month, and also gives an analysis of each account, so that we have a permanent record of what each bill is for, as well as the amount of it. This is invaluable, in posting from the cash book to the distribution sheets, for it not only shows where all the receipts shall be credited, but shows it in a small space as well. *All* the items of each bill are not entered, for if a customer should desire a second bill, or if, for any reason, we should wish to know what his bill was for, the items are easily found by referring back to the slips from which the original bill was made out.

The second book to which I have referred is the distribution book. This may be considered as the final summing up of all other accounts, — that toward which all other accounts have pointed, for this is the one to which we shall refer whenever we wish to learn how the business of the farm is getting on. By the use of this book it is possible to do away with a general ledger (unless one prefers to keep that also), and for our purpose it is much *more* valuable. The distribution book shows the entire amount of receipts and expenditures for each month, all on one page, and analyzed in such a way that the receipts and expenditures, for any particular part of the farm's work, may be seen at a glance. These sheets are then summarized on a yearly sheet, which shows the gross expenses and receipts for the year in a convenient and comprehensive way. Every item in the cash book, of whatever kind, is entered in the distribution book. This book must, of course, balance exactly with the cash book each month. The receipts are put in in red, in order that they may easily be distinguished from the expenditures, for both receipts and expenditures may, in some cases, be put in one column.

Many items will need to be analyzed before entering, in order to know that every detail of every bill shall be charged to the correct account. For instance, a bill for grain is divided in such a way that whatever was used for the cows is charged to cows; that used for poultry, to poultry; for horses, to horses, etc. For instance, if the farmer will indicate, on the slip which the dealer gives him whenever he buys grain, just which animals he is buying it for, he will not need to trust to his memory to divide up the bill at the end of the month.

A bill for hardware, too, may be partly for tools, partly for repairs to buildings, and partly for some permanent improvement. This bill should be divided accordingly, and so on with the other bills.

The receipts are taken care of in the same way. For instance, if a customer pays a bill — suppose Mrs. Brown pays her $15, that amount is divided between cows and poultry, according to the amount for butter, eggs, milk and cream. These figures are always available in the *bill book.*

I have here a sample page from such a distribution book. (See Fig. 2.) This shows only part of the headings which might be used.

The headings of the distribution sheet will depend on the nature of the farm. If a dairy farm, we would naturally be interested to keep a number of subheadings under cows, such as butter, milk, cream, stock, grain, labor and dairy; while if the cows were a secondary interest, we might need only one or two. If a poultry farm, we would divide up into several headings for the poultry; this, of course, in order to enable us to know at the end of the month, or the year, not only what the net gain for that particular thing was, but also to know in what special branch the greater part of that profit was made.

The question of dividing the labor into the proper accounts is always a difficult one. The greater part of it must necessarily go under the heading of general labor, but as far as possible anything which can be charged to a definite account is so charged. For instance, on a large poultry farm, where one or more men give all the time to the care of the hens, that time is naturally charged to the poultry account. Division of labor may be made quite accurately by the expenditure of a very little time; in fact, only a few moments each day, if a plan similar to that in use at one of the State colleges is employed. A sheet for each man and each team is kept, with a place to show, for each one, just where their work for the day is put in. This is the labor record to which I have already referred. (See Fig. 1.)

It is important, as far as possible, to separate, in everything, the charges for maintenance and general expenses from those for permanent improvements, for we want to be able to analyze our running expenses at the end of the year.

A yearly inventory is indispensable. Without it even the yearly distribution sheet will not show us just where we stand. That sheet might show a balance on the wrong side, but when the inventory is considered, there may be found such an increase over that of the year before as to more than offset the deficit in the account. On the other hand, we might have a good showing on the distribution sheet, which would be greatly reduced by a decrease in the inventory. But taking the two together, we shall be able to make up a statement which will show exactly where we stand.

Other accounts, their nature depending on the type of farm, will be found very helpful. On a poultry farm I would suggest keeping a careful egg record, and even if the number of poultry is small, such a record will be found to be well worth while. Samples of egg record blanks will be found in Figs. 3 and 4.

On a dairy farm a careful record of each cow is invaluable. By keeping a milk record, with which you are all familiar, and a record of the feed given to each cow (which is much more simple than you think, unless you have tried it), the bookkeeper will be able to work out all the other details found on this record, except the per cent of butter fat, for which you will need to make a test each month. (See Figs. 5 and 6.)

You may notice that I have made no account of the labor of taking care of the cow, and while this must be considered, in order to be perfectly fair, it is not shown on the card for this reason: all the other data on the cards are figures which may be accurately determined each month. Then, the question of labor for the whole herd is taken care of on the distribution sheet. So, at the end of the year, if we wish to add to the whole year's record an item for labor, it will not be difficult to work out an average cost per cow for the year. The value of the fertilizer and the selling price or value of her calf are items on the other side which have been omitted for the same reason.

It would be impossible, I think, to work out a system of farm accounting which could be uniform in all cases, for where one farm may require one plan, the next may require quite a different one. The general plan of the system which I have used in my work as bookkeeper is the same, but there are no two places which use just the same sort of records, as the differences in the farms, as well as the preferences of the owners, must be taken into consideration.

To a certain extent it might be said that accounting could be done equally well for a merchant as for a manufacturing concern, for a lawyer as for a farmer, once one has acquired the knowledge of bookkeeping; on the other hand, it seems to me that an accountant will do better work for a merchant if he knows something of a merchant's business than if he knows only figures; in the same way a person who knows nothing about a farm will have more difficulty with a farmer's books than one who does not have to inquire what is meant by such terms as pyrox, silage, balanced rations, butter fat, and so forth. So a bookkeeper who knew something about the business of farming would be more valuable than one who did not. The more he knows about the details of the farm, the better able will he be to analyze the accounts and keep each item in its proper place.

Because a farmer's books should be as simple as possible, it does not necessarily follow that it is a simple thing to keep them. A set of books which are simple and at the same time comprehensive and definite require, perhaps, more time in their first planning and later in the keeping of them, but one is infinitely repaid when any bit of information about the business is wanted, and it *will* be more and more wanted as its advantages are seen. How much better to give a few minutes each day to the books, in order to have them where every bit of information is easily available, than to do without them because we think we have no time, with the result that when we need a certain bit of information we must spend hours, perhaps, looking through papers, bills, books, and so forth, and then not find it, even in the end. I know the plea that you have no time to give to the books, that you cannot afford to hire any one else, that a farmer has no chance until evening for anything of that kind, and then he is too tired, after such a long day's work as his must be. If he is interested in having his books well kept, and if he can co-operate with several others who care to do the same thing, then this plan of a co-operative bookkeeper is, in my opinion, the best solution of his problem. In this way he has the advantage of an accountant who knows, not only accounts in general, but *farm* accounts in particular, and also has that accountant at a reasonable expense.

In every case I have found that the work which I have done on the accounts has stimulated the farmers themselves to a desire to know definitely about the financial side of their venture. Moreover, as they realized more and more the value of the records, they became more anxious to have them complete, and the suggestion to add a new sort of record has frequently come from the owner rather than the bookkeeper.

For instance, when it comes to the question of distribution of labor, the farmer may say, "It is impossible to divide the labor; most of the time of most of the men is general labor; we cannot split up each one's time." So I get from him, as best I can, a general idea of what the different men do, and then wait. By and by he comes to me, perhaps, about two men who, he has previously told me, were putting about all their time on general work. He will say, "You ought not to charge all their time to general labor; it is too much. They are really putting considerable time on that new building. I think we should keep an account of that, in order to charge it to permanent improvement." "Very well," I say. "That is just the sort of thing I want to get hold of." Then I have him start, in the simplest possible way, a daily record of the time of those men.

Of course you will understand that the accounts of the different farms are kept entirely separate. The co-operation simply consists in the group of farmers, each paying part of the bookkeeper's salary. It is not, in any sense, co-operative bookkeeping. The books of each farmer are absolutely distinct and apart from every other, and the business of each farm is kept as confidentially by the bookkeeper as if it were her own. Nothing must ever be carried by her from one place to another.

I hope that I have succeeded in making clear to you just how this plan of a co-operative bookkeeper has been worked out, and how it may be worked out again. If so, I am very glad, and I shall be happy to do anything I can to help any one who is interested to try out this plan for himself.

TERRACE HILL FARM, PETERBORO, NEW HAMPSHIRE.

Work Report of ______________________________ for ______________________ 191___

Wages ______________

DEPARTMENT OF WORK.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	No. of Hours.	Total.

FIG. 1.

Sample Page of Distribution Book.　　Gross Expenses　$288.50　　Net

Labor.	Repairs to Buildings.	Cattle. Receipts.	Cattle. Expenses.	Poultry.	Pigs.	Horses.	Tools.	Woodlands and Pastures.	Sundries.
55 00	15		33 00	21 77	2 00	18 50	30	15	15
90 00	2 00		20	35	7 00		2 00	5 00	10
25 00			9 80	8 00					37
2 00									1 01
3 00									
1 50									
15									
176 65									
				30 12	9 00				
105 55	2 15		43 00			14 00	2 30		

Fig. 2.

Old Town Farm, Peterboro, N. H.

Egg Collections.

Month.			House No.
Day.	A.M.	P.M.	Remarks.
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

Total

No. Birds

Average

Fig. 3.

EGG RECORD FOR______________191

No. Hens______________

Date.	A.M.	P.M.	Price per Dozen.	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Total				

FIG. 4.

FEED RECORD.

Date________________________191____

NAME OF COW.	Pounds of Mixture.	Pounds of Hay.	Pounds of Silage.	Pounds of Green Feed.	MIXTURE OF GRAIN.	Pounds.	Price per 100 lbs.	

Upland Farm. Price per lb. of Mixture Cts.

FIG. 5.

Name ________________ Register Number ________ Year ________

Age ________ When dry ________ When fresh ________ When bred ________

	Milk Lbs.	Fat.		Amount of Butter.	Value of Butter.	Value of Skimmed Milk.	Total Return.	Cost of Grain.	Cost of Roughage.	Total Feed Cost.	Profit.	Cost of 1 Lb. Butter.	Remarks.
		Per Cent.	Lbs.										
Jan.													
Feb.													
March													
April													
May													
June													
July													
Aug.													
Sept.													
Oct.													
Nov.													
Dec.													
Total													

Upland Farm.

Disposition of Calf ________________

Fig. 6.

Mr. F. A. Russell. There has not been a subject before the Board meeting this year, or any other year since I have been a member of the Board, that has interested me more than this subject which we are dealing with at the present time. As the speaker said in the beginning, we farmers do not know what we are doing; we do not know whether we are making money unless the old sheepskin is full. But I would like to ask the lecturer what amount of business a man would naturally have to do to be justified in hiring a bookkeeper; or, in other words, if a man is doing $10,000 or $15,000 or $25,000 worth of business a year, would he be justified in hiring a bookkeeper, in your estimation?

Miss Goddard. I should think he would.

Mr. Wheeler. Would Miss Goddard please explain how many farmers she thinks a co-operative bookkeeper could take care of? That is, farmers in the ordinary sense of the word. Perhaps she might be able to tell how many she took care of in her New Hampshire experience.

Miss Goddard. I took care of four farmers, and it required only about two weeks of each month, so that I could have taken care of eight very easily.

Mr. Hayden. I would like to ask how much of a bookkeeper's time would be needed to do the bookkeeping of a dairy farm of a hundred head of cattle.

Miss Goddard. I should think a week a month would be sufficient.

Professor J. A. Foord. I want to rise and second the remark of the Chairman about this paper, and say what an excellent paper I think it is. And I want to emphasize one or two points, especially along the lines of the questions already answered. What Miss Goddard said about the wife or daughter, I want to amplify a little and say, get the boy or the girl. I think perhaps the wife has enough to do. But I want to emphasize, gentlemen, the desirability of getting the young men interested in the accounting side of it. My experience is that it is hard work to teach old dogs new tricks, and the older men are not going to take up detailed accounting. But the young men we want to keep on the farm, and we want to show them that farming is profitable, because we know it is if properly conducted, with the best conditions for right living that there are. Now, the way to do that is to show your boy that you are doing it; and if you are not, why not? And I believe there is no better way or cheaper way for you to get your bookkeeping done than to put those children at it. The boy in the high school can just as well keep the accounts Miss Goddard has suggested as anybody, and the girls, I think, within reason. Now, I do not mean to throw any cold water on Miss Goddard's suggestions, because those children will not stay with us always. I think the co-operative scheme is excellent, but I do want to emphasize the desirability of interesting the young people in the business affairs of the farm, because when it comes right down to it that is what they are going out to look for when they look for a position, — the dollars and cents in it. We know that there is no better place than the farm. Now, one other thing I would like to speak of: Miss Goddard spoke of the purchase slip. I have found no simpler way of keeping the records on the college farm than the record made at the time of the happening, because I want to emphasize the fact that the time to make a record is when it happens, whether it is a pail of milk weighed or the sale of a pig, and the man who makes that record should be the man on the spot. Very frequently mistakes will occur that are easily corrected if you can show the original record. They may be rather hard to decipher sometimes if the man happens to be a Polander, but I believe this is an excellent plan. Miss Goddard spoke of the classification of items, speaking of the feed record. I agree very heartily. The time to classify items is when it happens. I haven't found it quite as simple as Miss Goddard said, but anyhow we do what we can along that line. Now, this classification is not so serious. Do not keep too many accounts the first year. Suppose you say this year, "We will keep an account of potatoes and find out what it costs to raise potatoes." I have been working on this accounting matter a good deal, because I believe every man should know what is doing in his business. Keep accounts as Miss Goddard has suggested, with the amount of labor spent in different operations in hours. Keep a general labor account of your men so that you will get the total cost of labor for the year. Now, at the end of the year, in your general labor account, you have got all the expenses of labor, whether for board or salaries, or whatever it is — it is all there. In each account under your cows, under your apples, or under your general crop you have the number of hours of labor; then it is simply a question of dividing the total expense for labor by the total number of hours for the average cost of labor per hour. It seems to me this is the simplest method I have seen. I can only close, Mr. Chairman, by once more commending the excellent paper, and I do hope it will influence more people to keep accounts. Don't be too ambitious. One account run through a year for one kind of crop will be more valuable than half a dozen for four or five or six months.

Mr. Wheeler. My idea in getting Miss Goddard here was not so much to give a general idea of how people could keep books, but with the idea of using a bookkeeper co-operatively. It seems to me that while the Massachusetts farmers may not be able to afford to hire bookkeepers individually, this system of co-operative bookkeeping and a co-operative bookkeeper can be worked out advantageously. I think we lack trained bookkeepers along this line, and I feel sure that just as soon as there is a call for bookkeepers to go around and make the circuit of different farms, this class of bookkeepers will be supplied by the business colleges and the agricultural high schools which are now advertising various trades, — the business and agricultural bookkeeper. I think we are at the present time in need of bookkeepers who can do the sort of work which Miss Goddard has described here to-day.

Mr. Foster. I would like to inquire of the lecturer how small a dairy or farm she knows of that has employed a co-operative bookkeeper.

Miss Goddard. Well, I think none would be too small. I know of a case of a farmer who had four cows and perhaps not more than forty or fifty hens, and other things accordingly. It took me only one day a month to do all the work.

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CO-OPERATION IN FRUIT GROWING AS PRACTICED IN NOVA SCOTIA.

BY W. H. WOODWORTH.

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CO-OPERATION IN FRUIT GROWING AS PRACTICED IN NOVA SCOTIA.

W. H. WOODWORTH, BERWICK, NOVA SCOTIA.

It is constantly remarked, and perhaps with a certain amount of truth, that farmers, as a class, are so set in their ideas that it is impossible for a body of them to work together to accomplish any particular purpose.

This co-operative movement, of which I am to speak to you, was organized in 1907 by a few of the best fruit growers in Berwick, a pretty village in the heart of the fruitful Annapolis valley in Nova Scotia. The method of handling the fruit products of the valley prior to this date was very easy and eminently satisfactory to a certain few individuals, but far too easy and satisfactory to be much appreciated by the fruit growers.

The European commission houses handling Nova Scotian fruit had their agents over here. During the shipping season these agents had subagents at nearly all railway stations from which any quantity of fruit was shipped. On an appointed day the farmer would pack his apples at home and haul them to the station, where the subagent would make up carload lots and forward on his immediate superior's orders. These apples were then left to the tender mercies of the consignees, who, when they eventually sold them, would commence piling up an account of charges that were really startling in their ingenuity. A charge was made for every conceivable thing under the sun, including commission for every one who had anything to do with the apples, and when all was deducted that the consignee's conscience would allow, the farmer received an account of sales and sometimes a check representing what remnant of the wreck remained for him. The farmers chafed under this system of disposing of their products, but individually could do nothing.

An attempt was made about ten years ago to organize some kind of a co-operative movement, but owing to the fact that it was on too comprehensive a scale and was not founded on business principles, it was a failure.

In 1907 a few of the most up-to-date and energetic farmers in Berwick made up their minds, however, that in co-operation alone was to be found a cure for the state of affairs that then existed. The product from their orchards was increasing year by year, and they realized that there were only two ways in which they could give proper attention to the packing and grading of their fruit. One way was to build individual apple houses on their farms large enough to permit of fruit being stored and packed; another way was to get together and build or buy a large warehouse on the line of railway, where the apples of all could be stored and packed. The latter was the scheme that appeared the most attractive, and these men formed the first co-operative fruit company in Nova Scotia.

This company was called the Berwick Fruit Company, and was incorporated under the Nova Scotia joint stock companies' act, with an authorized capital of $10,000. Warehouse accommodation was secured, and during the first season some 7,000 barrels of apples were handled. This company did not limit its sphere of usefulness to the mere handling of apples, but it aimed, also, at being an educational power. The leaders of this movement soon found that one of the most important factors in successful co-operative fruit packing was the production of good fruit. The company therefore used its best influence to educate its members and also farmers generally in the matter of careful cultivation, spraying, and the other operations necessary to secure high-class fruit.

At the beginning of the second season the membership of this company had doubled, and a new warehouse was purchased.

In 1908 the output of this company was 15,000 barrels, which increased the following year to 22,000.

The early history of this company is a splendid demonstration of what can be done by a body of men associated together for the common benefit. The superiority of the pack put out secured splendid prices. While farmers outside the company had to be content with $1.25 per barrel, tree run, for their apples, the members of the co-operative company were receiving $2.65 for No. 1 grade of fruit, $1.90 for No. 2 and $1.22 for No. 3.

News of the phenomenal success soon spread, and in 1909 five more companies were incorporated under a new act enacted especially to facilitate the incorporation of such companies. The following year saw that number increased.

The apples of all members of co-operative companies are packed at the warehouses by experts. No farmer who is a member of a company is permitted to pack any standard variety at home, neither is he allowed to sell except through his company. Thus the companies are able to put up a uniform pack which they can guarantee. A farmer joining a company agrees to pool his apples, and he is paid the average price realized for each variety in the three grades. Thus there is a direct incentive to raise good fruit, for the member receives the average price for the grades into which his fruit packs.

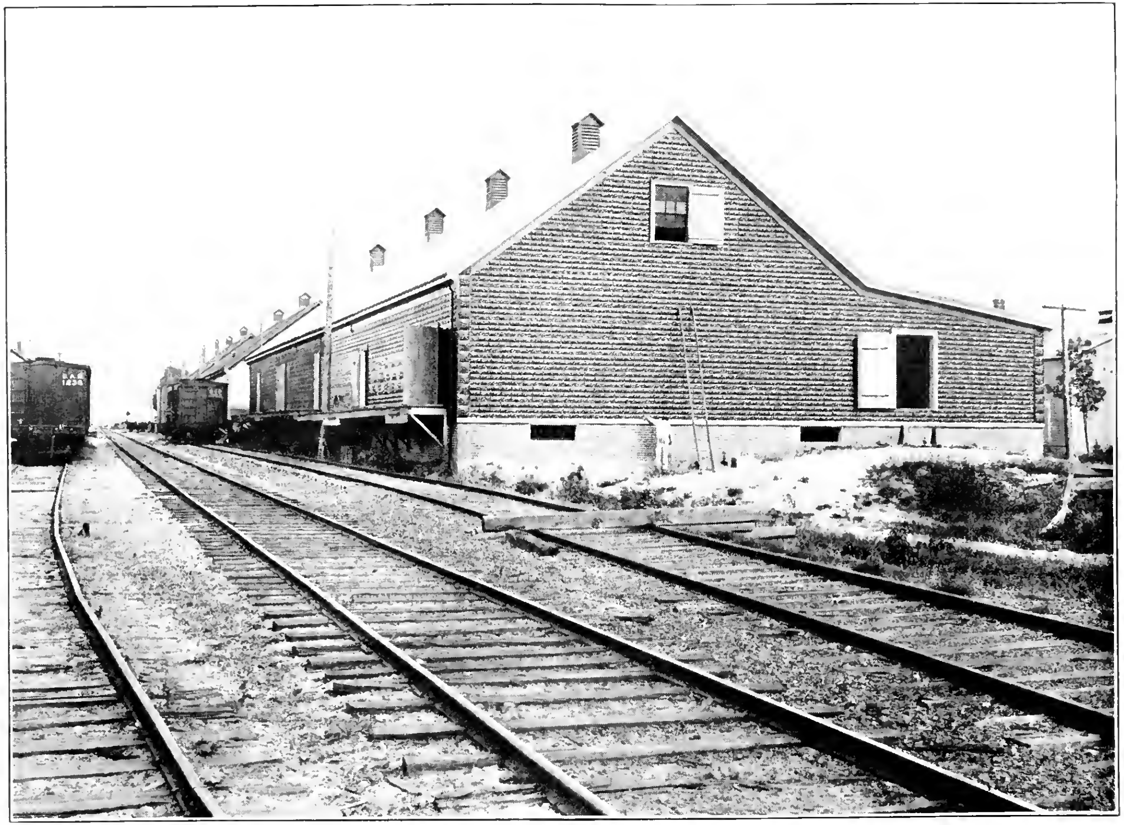
It was realized, however, by the leader of this movement that while much could be accomplished by individual companies, it needed concerted action on the part of all companies to carry this co-operative idea to its logical conclusion. The companies were valuable factors in educating their members in the matter of cultivation, spraying, and improving the pack of their products. As individual companies working entirely independently of one another, however, they rather defeated the very idea of co-operation, because they really became competitors of one another. Speculators were wont to play one company against another, so that the superior pack did not make that extra money that its quality merited.

It was also realized that if the companies could work together large savings could be effected in the purchasing of supplies, such as fertilizer, nails, pulp heads and spray materials. The matter of transportation could also be better and more economically handled.

A conference was held and it was determined that some form of centralization was necessary. At this point, however, the Nova Scotia farmers showed that while they were ready to consider new ideas and act on them if their judgment pronounced them good, yet they would not "buy a pig in a poke." They decided, therefore, that they would give this centralization scheme a trial for a year and see just what could be accomplished before floating the Central as an incorporated body. An executive committee of three members was elected from the leaders of the companies, some twenty-two in number, who decided to participate in the movement. The farmers were fortunate in their choice.

As I stated before, the companies did not tie themselves to the Central Association in any way, they contributed nothing to found or start it, and were under no legal obligations to support it. The work of the Central was to attend to the matter of transportation, make what sales it could for the companies, buy supplies and generally assist all affiliated companies. Companies wishing to affiliate paid an entrance fee of $5. To maintain itself the Central charged the companies a small percentage of what apples it sold and earned certain money, as will be explained later. This Central Association came into existence in July, 1911. The whole scheme was an experiment, and no company was compelled to supply a single barrel of apples, to fill orders taken by the Central, if it thought it could do better elsewhere. Under these circumstances it is little short of wonderful that at the end of the season the manager was able to report an unqualified success. Great credit is due to the companies, the majority of which, I am glad to say, stood by their Central. There were a few weak-kneed companies, but these dropped out early in the game.

A brief résumé of the work accomplished by this experimental Central Association may prove of interest to you. In the first place Nova Scotia had that year a record crop of apples. The very magnitude of the crop gave the Central its first opportunity to demonstrate its usefulness. With such a large crop there was naturally a lack of laborers to harvest it. The Central advertised for help, and in response to their appeal a small army of laborers invaded the valley and were distributed by the Central to the various companies who had previously made their requirements known. These companies in turn passed the help on to each of the members who required it. Previous to this action by the Central Association the valley laborers were demanding an unreasonable remuneration for picking. The advent of the additional help, however, knocked the bottom out of this "hold up," and the growers, even those altogether outside of the movement, were able to harvest their crops at a reasonable rate.



Warehouse of the United Fruit Company, Berwick, Nova Scotia.

It had long been thought that a good market for the farmers' Nova Scotia Gravensteins could be found in the Canadian west. This splendid apple never had a chance on the European markets on account of the large quantities of English fruit always available in those markets early in the season, and the lack of fast boats to place it on that market in prime condition. The Central engaged a man of marked ability as a salesman to go west and see what could be done. As a result of this short trip some 12,000 barrels were shipped to the northwest provinces by the Central Association. The opening up of this market has proved a great boon to the Nova Scotia apple trade, for, as is ever the case when a new market is found, the old markets were relieved and thereby steadied, resulting in better prices all round. Verily, in this initial year, the Central Association did not lack opportunities.

Take the matter of transportation for instance. The supply of steamships, usually all sufficient to carry the apple crop to European markets, proved totally inadequate to cope with the tremendous quantities of early fruit sent forward. The end of September saw the Halifax terminal blocked, its cars of fruit sweltering in the sun, and no boats to carry it to market. The Central Association quickly grasped the situation and dispatched four train loads to Montreal, connecting there with fast boats to England. This, however, was only done as a temporary relief. In the meantime they chartered four boats, which carried some 40,000 barrels out of Halifax, and so effectually relieved the situation to that port that a similar congestion did not occur again throughout the entire season. I claim that the farmers of the valley were saved thousands of dollars by this action. Not only did the members of the companies benefit, but the entire body of fruit growers. That action alone justified the existence of the Central, and should have earned for it the support of all fair-minded and clear-thinking men.

The Central Association also proved a great selling factor. During the season it sold for the companies 102,000 barrels of apples, and, what is quite as important, made good prices. Another very useful work accomplished was the securing of space on steamers and attending to the shipping of the companies' apples. During the season 400,000 barrels of apples were shipped on its bills of lading.

In the matter of marine insurance a great saving was effected. The fact that the Central had some 400,000 barrels to insure, secured for the company an exceptionally low premium, and materially reduced that little item seen on most accounts of sales, which in the course of a year amounts to a considerable sum. Insurance of the warehouses and contents was also effected at a very close rate, the Central earning the commission usually going to the agents.

Supplies were bought at very low figures. An order for 1,250,000 pulp heads and 500 kegs of nails naturally secured inside prices. The largest saving, however, was made in the purchase of fertilizers. Many companies who had stood loyally by their Central throughout the apple deals backed out when it came to buying fertilizers. Only a few companies, therefore, were working with the Central in this field, but even then 2,283 tons were handled. The fertilizer was bought at a saving, compared with the lowest price quoted by the agent, of about $3 per ton. Fertilizer agents assured the companies that they would guarantee them as low a price as the Central could give them, and others advertised openly in the press that they would supply fertilizer at even lower prices than could be obtained through the Central. Thanks, however, to the business acumen of the managers, the fertilizer agents were soon glad to withdraw those advertisements, and the companies who stood by the Central were able to divide a net saving of $6,800 on their fertilizer deal.

I know some companies whose lack of faith in their Central cost them $4 per ton on their fertilizer supplies. One should not be too ready, however, to blame those companies; after all it was only an experimental year, and it is not strange that some should look askance at the idea of giving their order blindly without knowing how much their goods would cost them. At the same time all the more credit is due to those who were sufficiently imbued with the right spirit of co-operation to do this.

The great thing for the individual to remember, however, in a co-operative movement, is that after all it is not a Central

Association selling you material; it is you yourself buying material at first cost through your own buyer, that is, your Central Association. The Central did not work to make any profit out of the affiliated companies. Supplies were distributed at cost and apples were sold at cost. A small levy was made on all apples sold to cover the expenses of the Central, but owing to the economical manner in which things were worked out, money being earned by the Central in various ways already indicated, the entire business of the companies was handled at the ridiculously low cost of three-eighths of a cent per barrel. Thus did the leaders of this movement demonstrate to the farmers what could be done by co-operation.

During the winter months a special bill had been prepared to enable the Central Association to be incorporated. This bill, with certain modifications, was passed by the House of Assembly at Halifax. Steps were taken in June, 1912, to complete the organization of this movement and to incorporate as many companies as possible into one central body.

The speculators who had so long made a very lucrative living out of the farmers did not allow this organization to be effected without a determined opposition, but thanks to the zeal and untiring energy which was put into it, twenty-four of the twenty-seven co-operative companies signed the memorandum of association, which gave birth to the United Fruit Companies of Nova Scotia, Limited. The company is incorporated with an authorized capital of $200,000, of which $76,000 is subscribed, each subsidiary company subscribing 20 per cent. of its authorized capital. The organization meeting was held at Kentville on July 8, 1912, the companies being represented by seventy-two delegates. By-laws were adopted and directors and officers were appointed, each company being represented on the directorate by one representative.

Ten other companies have been formed and have come into the Central Association since organization, so that there are now thirty-seven companies. All the companies agreed to come in under a by-law which gives the Central Association complete control of all their fruit. All apples are pooled and average prices are returned to the companies according to the class and grade of fruit packed.

These companies collectively have a membership of about 2,500 of the most up-to-date and progressive farmers of the valley. The United Fruit Companies can therefore claim to have control of the best fruit produced in the finest fruit producing district in Canada.

There are forty-seven warehouses belonging to the companies, having a total frost-proof storage capacity of 750,000 barrels of apples. These warehouses are turning out on an average 25,000 barrels of apples a week. Eight steamers and ten schooners beside the regular boats have been chartered by the company. Three of the companies have erected evaporators, where the cull apples are used up, thus reducing waste to a minimum. It is the aim of the United Fruit Company to establish and maintain a uniform high standard of pack, which they guarantee. It is considered that in this way a demand will be created for co-operative packed fruit, which will naturally mean higher returns. Already the superiority of this pack has been noticed. Fruit inspectors have reported on it to Ottawa, and Ottawa in turn has congratulated the companies. Disinterested persons in various parts of Canada have commented on it in the press. And above all it is reported that the European buyers now look for and demand the co-operative mark. Thus it can fairly be said that the aim of the companies has been accomplished.

Great importance is attached to this matter of good pack, and to maintain uniformity the chief inspector visits every warehouse constantly; spending a little time at each, inspecting barrels packed, and giving instructions. His reports concerning conditions prevailing at each warehouse are carefully noted and filed.

New markets are constantly being sought, and in this connection much valuable work has been accomplished. Markets on the continent of Europe hitherto supplied through a series of middlemen are now being supplied direct, and trial shipments are being made to other hemispheres where the Nova Scotia apples, the apples with the flavor, have never previously been tasted, but where it is hoped a demand will be created. As the shipping season is only at its early stage, it would be premature to talk about what has been accomplished this year. Suffice it

Apples stored in United Fruit Company's warehouse, Kentville, Nova Scotia.

to say that up to October 31, 206,000 barrels and 42,000 boxes had been shipped, and quite a fair proportion of this quantity had been shipped to fill orders.

The wonderful success that has attended the co-operative movement is having a telling effect, and applications are being constantly received from responsible farmers asking for assistance in forming companies in their neighborhoods. Nine such companies are now in course of organization, and at the end of the apple shipping season a vigorous campaign will be conducted to still further extend the scope of this movement.

It is not proposed that the shipping of apples and furnishing of fertilizer shall be the sum and substance of this movement. A more ambitious program is mapped out. It is proposed that in time everything that a farmer requires on his farm or in his home can be purchased through the co-operative companies. Advertisements are seen daily, setting forth the advantage of buying direct from the makers. Through the co-operative movement the farmer will get his supplies direct from the makers, minus even the advertising expenses, and with all the saving in cost which is always effected when a large quantity of any material is bought. Through co-operation the farmer buys his supplies direct from the producer and sells his product direct to the consumer. The small army of middlemen, who have been making a comfortable living out of him on both sides, has to retire and he, the producer, gets the full value of his money on the one hand, and gets all the money that his produce makes on the other.

As I stated before, the United Fruit Companies have a very ambitious program. It contains such items as the erection of cold-storage plants, the running of a line of refrigerator cars, erecting or purchasing large department stores, erecting saw-mills and cooperage and box-making shops, and even banking and insurance. Indeed the possibilities are unlimited. See what has been done in Europe. Who will say that what Denmark has accomplished is not possible in Canada?

One does not expect all this in a year, or two years or even five years, but given judicious management and capable officials in all departments and in ten years I look to see the United Fruit Companies of Nova Scotia the most powerful organization in eastern Canada.

The Central Association has an efficient office staff working on an organized system. Instructions are sent out from the Central office constantly to all subsidiary companies, directing as to varieties to be packed and how, when, and where to be shipped. Space on the various boats is allotted to the companies, and directions issued as to method of shipping, etc. Statistics are compiled showing quantity and condition of crop throughout the American continent and Europe. Constant telegraphic advices are received and recorded, giving total estimated shipments of apples from all ports to all ports. Prevailing conditions on all markets are recorded daily, and reports received from our representatives and agents from all markets touched by the North American fruits. All the reports are carefully studied and instructions issued as a result. The organized fruit growers of Nova Scotia this year demonstrated to the world that co-operation is a mighty factor.

As soon as the unreasonable increase of ocean rates was communicated to the Central office, it was recognized that unless immediate action was taken the Annapolis valley would be subjected to a tax which would be nothing short of murderous to its industry. The increase of 32 cents per barrel was utterly indefensible; the claim of the steamship companies that additional war risks had to be paid did not form sufficient excuse, as less than half the amount of the advance would more than cover any additional cost in that direction. It was simply an attempt on the part of the combine to take advantage of the war to make those who were forced to ship pay a rate that would make bigger profits for the steamship owners.

There were two ways of combating this menace; one, was an appeal to the government at Ottawa, and the other, was by chartering boats owned by concerns outside of the Atlantic combine. The United Companies pursued both courses.

A strongly worded protest was immediately mailed to the minister of trade and commerce. The shippers of the United States were also appealed to with a view to bringing pressure to bear on the combination through the American trade. It was found that the American shippers were all ready to co-operate with the United Fruit Companies, who were alone on the Canadian side in fighting the increase in a determined manner. The Dominion fruit conference was about to be held and the officials of the United Fruit Companies attending that conference were instructed to bring the matter up as an emergency.

In the meantime the strongest weapon of the organized fruit growers was used. Steamship brokers were instructed to ascertain what independent tonnage was available for chartering, and it was quickly found that no difficulty would be experienced in obtaining all the boats necessary to carry the United Fruit Companies' apples. The United Fruit Companies then informed the International Combine that they proposed chartering independent boats, and as an indication that this was no idle threat two boats were chartered. This had the desired effect and we were quickly notified that the steamship companies had decided to reduce the increase by 19 cents.

Now the moral to be drawn from this short but sharp fight is that organized and united the fruit growers of the valley are a power, a power that can demand and obtain fair treatment. The fact that the organized fruit growers were powerful enough to charter their own boats and powerful enough to be absolutely independent of the regular steamship lines has saved the valley 19 cents on every barrel of apples that will be shipped. Consider what this means. If only 600,000 barrels are shipped this year the United Fruit Companies will have saved the valley \$114,000 — \$114,000 in the pockets of the growers instead of the pockets of the steamship companies.

If the United Fruit Companies had not been in existence, the advanced freight rates would have gone into effect and the growers would have had to pay, or allow their fruit to rot. The few big shippers probably would not have paid the increase, but that would only be a repetition of what has happened previously, and the ordinary growers would have had to pay, while a few privileged individuals would not. By taking space and retailing it to smaller shippers, the favored few would have become just so much richer at the expense of their less fortunate brethren.

As individuals, the growers can do nothing; as an organized body working co-operatively, they are a power to be considered.

The co-operative movement in Nova Scotia is just what I say it has been. And I will quote from the annual report of the co-operative society for last year: "Your purchases for the past year have included 575,000 pulp heads, 35,000 pounds of nails, 67,800 pounds of grass and clover seed, 22,745 pounds of other seeds, 48,300 pounds of vetches, 4,500 bushels of seed oats, 2,060 barrels of flour [and they bought a lot more flour just before the war], 19,649 bags of feed, 6,044 tons of fertilizer, 104,000 pounds of arsenate of lead, 8,900 rods of steel fence, 1,800 barrels of lime sulphur, 2,200 pounds 'Black leaf 40.' These supplies have cost in round figures about $183,000."

Our country is especially fitted for co-operation, because the Dominion Atlantic Railroad runs from one end of the valley to the other, and the warehouses are dotted all the way from Digby to Yarmouth, and at Berwick we have six more. The central office does all the selling. They get their orders from England, from the Canadian west, or wherever it may be. Each warehouse is notified by telephone or telegraph how many barrels to put into that particular lot.

The great trouble we had was to get the farmers started. They are a suspicious lot of men, afraid somebody will make a dollar out of them. In Nova Scotia the great talk against the co-operative companies is that the manager is making some money. Of course you can't get a good manager unless you pay him. Last year it cost about 4 cents a barrel for all the apples that were handled by the co-operative company to pay the total running expenses of the whole business for clerks. We have a splendid system of bookkeeping, too. Every man knows what his apples bring, and we have auditors to handle the books so that there is no possibility of fraud, and up to the present date the movement is working very well indeed. Our apples go to Africa, Cape Colony, Glasgow, England and the Canadian west, and we are opening up a market now in South America. We sell very few apples in the United States.

Question. In what condition are the apples when picked and taken to the warehouse?

Mr. Woodworth. They are picked in the orchard carefully, and the early apples taken to the warehouse in barrels with a little bit of burlap and a hoop drawn over it. The later fruit is put in the barrel and the heads are put in upside down, and they are shipped to the warehouse and stored there. They are all put in in blocks, a block of Baldwins and a block of Greenings, and shipped out just as they are wanted. The warehouses are kept very neat and clean, too, and everything piled up in them, and it is a pleasure to go in.

QUESTION. How far are the warehouses from the orchards?

Mr. WOODWORTH. Oh, 4 or 5 miles at the most. Not 5 miles now, because you see the valley is only about 6 miles wide, and the railroad runs through the center. I am 2 miles from the station. We draw 35 or 40 barrels to a load and draw 4 loads a day. Pick up the apples, load them in the wagon and go right down and get your slip from the warehouse for every barrel of apples you put in.

QUESTION. You said you headed the barrels in the orchard.

Mr. WOODWORTH. Yes, we put the heads in upside down so that it gives a little more space. We do not press them down in the orchard; we shake them down, jar them down when we pick them, and then shove the head in.

QUESTION. Are they all repacked?

Mr. WOODWORTH. All are graded and repacked at the warehouse.

Mr. WHEELER. I would like to ask if you consider the co-operative association takes the place of passing necessary laws, — for instance, a grading law?

Mr. WOODWORTH. Oh, no. These companies have to be looked after. I have got a copy of the inspection and sale act of Nova Scotia. If you people had this law it would be the best thing you ever had. I will quote one or two paragraphs: —

> Fancy quality, unless such fruit consists of well-grown specimens of one variety, sound, of uniform and of at least normal size and good color for the variety, of normal shape, free from worm-holes, bruises, scab and other defect and properly packed; No. 1 quality, unless such fruit includes no culls and consists of well-grown specimens of one variety, sound, of not less than medium size and of good color for the variety, of normal shape and not less than 90 per cent free from scab, worm-holes, bruises and other defects, and properly packed.

Now, that is the No. 1, but they say there must be 90 per cent good, clean fruit. We intend they shall be all good clean fruit, but perhaps some man may not have good eyesight and they allow 10 per cent leeway — the law does — for some of that kind of stuff to come in.

No. 2 quality, unless such fruit includes no culls and consists of specimens of not less than medium size for the variety, and not less than 80 per cent free from worm-holes and such other defects as cause material waste, and properly packed.

That is the No. 2 pack.

In any package in which the face or shown surface gives a false representation of the contents of such package; and it shall be considered a false representation when more than 15 per cent of such fruit is substantially smaller in size than, or inferior in grade to, or different in variety from, the face or shown surface of such package.

You see, that fruit must be all the same all the way through. If you pack a box of apples down in our country and the face does not represent the whole, then you are hauled up.

Every person who, by himself or through the agency of any other person, violates any of the provisions of sections 320 and 321 of this act, shall be liable, for the first offense to a fine not exceeding $25 and not less than $10; for the second offense to a fine not exceeding $50 and not less than $25; and for the third and each subsequent offense to a fine not exceeding $200 and not less than $50, together, in all cases, with the costs of the prosecution; and in default of payment of such fine and costs shall be liable to imprisonment, with or without hard labor, for a term not exceeding one month, unless such fine and costs, and the costs of enforcing them, are sooner paid.

Now, that is the law of our country, and it is enforced in Nova Scotia by about fifteen fruit inspectors, and those fruit inspectors appear constantly when you are packing apples in your own home, and are in the co-operative places every day. It has raised the standard of Nova Scotia apples above what it was a few years ago, and which gave Nova Scotia apples a bad name on the London market.

A view in the Gaspereaux valley, Nova Scotia.

Whenever such violation is with respect to a lot or shipment consisting of 50 or more closed packages, there may be imposed, in addition to any penalty provided by this section, for the first offense 25 cents, for the second offense 50 cents, and for the third and each subsequent offense one dollar

for each barrel. This act is not only for Nova Scotia, but for all of Canada. Our fruit inspectors are at Halifax when the fruit is being shipped, — they haul up the barrels there, — and they are in the warehouses. They give no certificate, though, of inspection for any lot. They can't open all the barrels they go through.

QUESTION. What was the beginning of this law? What brought it about? Did it come through the growers?

Mr. WOODWORTH. Our Fruit Growers Association approached the government and blocked out a bill and got it passed through the Dominion Parliament. There has been some complaint from people who did not want to put their fruit up well. But the thing now has become a law and we have got to respect it, and I can tell you that I have packed 2,500 barrels of apples this year and we are very particular. Many men, perhaps, in this State do not need any law, but a lot of them do. If you could see some of the apples I saw at Lewiston last year, where a barrel was bought in the open market and brought in, it would make you smile. The man who packed those apples didn't know how to pack a barrel of fruit. Now, I have got about a quarter of an hour and I will give you some points in fruit growing in Nova Scotia.

Successful Fruit growing in Nova Scotia.

The Annapolis valley is situated between the North and South mountains, running from Windsor in the east to Annapolis Royal in the west. The average width of this valley is 6 miles, and practically all the apples grown in Nova Scotia are grown in this valley. Grand Pré, made famous by your poet Longfellow, is situated in the eastern section of the valley. Apple trees were first planted here by the Arcadian French. Some of these trees are still bearing fruit. The varieties grown are Gravenstein, Ribston, Blenheim, King, Golden Russet, Baldwin, Rhode Island Greening, Stark and Ben Davis.

In the year 1880 it was thought wonderful that 41,000 barrels should be exported, yet by 1911 the quantity had risen to nearly 2,000,000 barrels. New orchards are planted every year, and as yet only a small fraction of the total area has been set. Orchards that have been planted during the last twenty-five years are set 33 feet each way, which for a standard orchard is about right.

Special attention is paid by the successful grower to the following points: —

Cultivation. — Most of the plowing in the larger orchards is done in the autumn, preferably after the leaves have fallen. Early in the spring, as soon as the land is fit, the land is harrowed with disc harrows, followed in ten days with spring tooth and later with smoothing harrows. The cultivation is kept up every ten days until the 1st of July. At this time cultivation ceases, and the entire area is sown with a cover crop of summer vetches or tares. These vetches grow luxuriantly and produce a very heavy crop, which is plowed under in the autumn. This is of great value to the soil, as it adds an immense quantity of humus, which is heavily charged with nitrogen gathered from the air during the growing season by the millions of bacteria which are ever working, although unseen, in the interest of the orchardist. The conservation of moisture is one of the most important results of cultivation. The stirring of the top soil breaks up the capillary tubes that bring the water from below, and evaporation is checked. Two other advantages of cultivation are that soil under thorough cultivation has a larger amount of plant food available for plant use, and the finely pulverized soil offers no resistance to root development, and thus helps the trees to extend their feeding area.

Fertilization. — Another important factor in successful orcharding is keeping up the fertility of the soil. Without a generous supply of plant food the trees will not make a satisfactory growth or produce a paying crop.

For nitrogen, large quantities of nitrate of soda are used. Ground fish, obtained from the Fish Reduction Works at Carver, Nova Scotia, is a splendid fertilizer. Nitrogen is also supplied by manure and the plowing under of leguminous crops.

Basic slag from the steel works at Sydney, Nova Scotia, has been successfully used the past few years as a source of phosphoric acid. It also has a percentage of free lime which has a beneficial effect on the soil. In the past, large quantities of muriate of potash have been used in our orchards, but the farmers are not using much of late years, as our soils contain plenty of potash, which needs only cultivation to make it available. I might mention at this point that land of a wet nature must be thoroughly underdrained before success is possible. Trees will not do their best with wet feet.

Pruning. — Most of the pruning is done in March and the early part of April. Our trees are headed out about 3 feet from the ground, and are cut back a little each year so as to form a low-headed tree. A tree that is low headed presents many advantages over the tall slim tree. The former is easily sprayed. The picking of the fruit can be done with much greater care. The tree itself is much stronger, and is not affected by winds.

Spraying. — The operation of spraying is not a pleasant one. Spraying has become universal in our valley. For a long period Bordeaux mixture and Paris green was the spray used, but of late years lime-sulphur with arsenate of lead as a poison has almost entirely taken the place of the former.

The black scab or spot is the greatest enemy we have to fight. Spraying should be done while the trees are dormant, with the 1 to 8 or 1 to 9 mixture of lime-sulphur; then before the blossoms open, with lime-sulphur 1 to 40, and 2 pounds of arsenate of lead; and again after the petals have fallen, with the same mixture; and if necessary, after another period of ten days. Fine, thorough spraying generally does the work. The operation must be thoroughly done and every part of the tree must be reached. Power sprayers are used in almost every instance.

QUESTION. What variety of vetch do you use?

MR. WOODWORTH. Just the common vetch or tares, not the hairy vetch, which is more expensive. The vetch we use costs $2 a bushel.

QUESTION. How much do you seed to the acre?

MR. WOODWORTH. One bushel. Have your land in a good state of cultivation, then just go over it with a smoothing harrow after you sow your vetches. They grow fast and form a nice bed for the apples to fall on later.

QUESTION. What do you pay for basic slag?

Mr. WOODWORTH. I have to pay $13 for basic slag through the companies, and I think it is 12½ per cent of phosphoric and about 40 per cent of free lime. It has quite a high percentage. You know they put the limestone into the furnaces at the steel works and the dross comes out, and the finer it is ground the better for us. This works splendidly on the low lands on account of the phosphoric acid it contains.

QUESTION. Are you troubled with the aphis?

Mr. WOODWORTH. Yes, we used to be. You must keep in touch with the professors so as to know when the aphis is coming.

QUESTION. How can you tell whether you are going to have it or not?

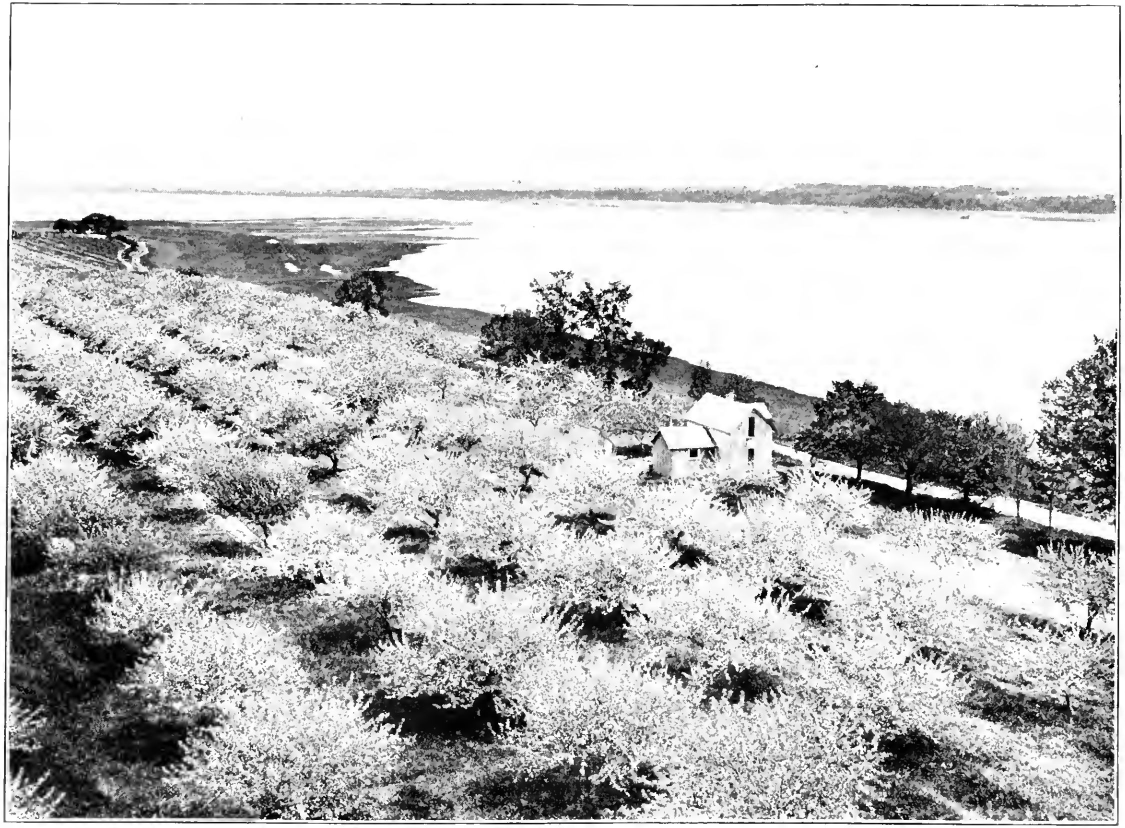
Mr. WOODWORTH. You can see these little aphides very early in the spring. Quite a lot, I believe, depends upon the season. But we examine our trees with a glass just as soon as the very first leaves commence to show, that is, when the little aphides hatch, — and we get intelligence, too, from all over the valley, — from the fruit companies, — and the spraying is all done about the same time of the year. The indications for aphis are reported at the central office, and we have a co-operative newspaper which spreads the news all through the valley, which is a great aid to us.

QUESTION. Do you have the tent caterpillar?

Mr. WOODWORTH. Yes, a few. But, as I say, the black spot is what we are fighting, and I expect it is the damp weather conditions that cause it down there.

QUESTION. Do you use any Bordeaux in fighting the black spot?

Mr. WOODWORTH. We used to rely on Bordeaux. I used to go around the country with lime and blue vitriol and mix Bordeaux, and show the farmers how to apply it; but since lime and sulphur came in I have used Bordeaux only one or two years. Lime-sulphur has taken its place. The only objection I have to Bordeaux is that it russets the apples. I can't grow apples unrusseted by the use of Bordeaux, and I can grow clean fruit with lime-sulphur.



Apple country in King's County, Nova Scotia, looking toward Grand Pre.

QUESTION. Do you ever have any trouble with burning foliage with lime-sulphur?

Mr. WOODWORTH. No. I don't think there is any trouble with burning the foliage if you don't get your mixture too strong.

QUESTION. What do you pay for commercial lime-sulphur?

Mr. WOODWORTH. Eight dollars a barrel, 40 gallons. If you want to make lime-sulphur cheap, get some brick, a 2-inch plank, make a little brick furnace with a wooden box with a sheet-iron bottom, about 6 feet long and 35 inches broad, nail it on with two rows of tacks, put a bit of stove pipe up through the end for a draft, and put in a hundred weight of sulphur to 50 pounds of lime, and boil it one hour and draw it off. Take a hydrometer and test it, and use it according to the hydrometer test. The test of the hydrometer gives the strength. You have to pay $2.25 for the sulphur and about 25 cents for the lime. In April you can boil your lime-sulphur when you are doing nothing else, and I have saved $50 this year.

QUESTION. What formula do you use for Bordeaux mixture?

Mr. WOODWORTH. Forty gallons of water and 4 pounds of blue vitriol and 4 pounds of lime. You should dilute the 4 pounds of blue vitriol with 20 gallons of water in a barrel, and the 4 pounds of lime with another 20 gallons of water, and then pour simultaneously into a third barrel; if you don't do it this way your Bordeaux is no good.

QUESTION. How much growth do you get on a tree?

Mr. WOODWORTH. On a tree that is fruiting never over 4 or 5 inches of growth.

QUESTION. Do you thin your apples?

Mr. WOODWORTH. Well, we want to; it is a hard proposition, the thinning of fruit. We have only thinned a very few trees, and I know that it is the right thing to do, but we have not done it. Our best fruit growers do. Thinning will become universal in a little while.

QUESTION. Do you raise any small fruit along with the trees?

Mr. WOODWORTH. If you grow small fruit the raspberries and strawberries sap the soil of its fertility. I have always noticed that where a man grows strawberries between the trees his apple-tree leaves are all yellow. We grow apples and turnips and get huge crops in between the rows.

QUESTION. Are not currants good?

Mr. WOODWORTH. We never grow any currants between the trees. We grow some raspberries.

QUESTION. At what age do your trees bear?

Mr. WOODWORTH. Well, the Wageners begin to bear about three or four years after they are set out. Of course, they are small trees and can't bear very large crops. I have an orchard planted out about thirteen years, — 30 acres of orchard, — and that has given me a splendid crop, averaging 50 bushels to the acre; that would be a barrel to a tree. Of course, some trees have two barrels on; others don't have any.

QUESTION. What do your apples bring a barrel this fall?

Mr. WOODWORTH. Our apples for export have brought about $1.60 through the co-operative companies. You count that a small price; for these war times we count it a very good price.

QUESTION. How much is the profit on a barrel of apples at that price?

Mr. WOODWORTH. Fifty cents. We pay 28 cents for barrels; it costs us about 12 cents to get them packed; they do it a little cheaper this year than they have been doing it. Of course, in the co-operative movement we have to pay for what it costs.

QUESTION. You pay for picking?

Mr. WOODWORTH. We pay for picking usually $1 a day. I have paid more. If we could get experienced pickers we would pay them more, but we usually get new pickers each year, and if you have ever attempted to pick apples with a lot of fellows that never had picked them before you know that all you hear is a basket falling, or a man, and by the time you have them well taught the season is over.

QUESTION. Is the business done through your co-operative societies done on a cash basis?

Mr. WOODWORTH. Yes, we sell all the stuff for cash, except what we send to the other side, and on that the returns come back as soon as sold.

QUESTION. What temperature do you keep in the warehouses?

Mr. Woodworth. We try to regulate the temperature as well as we can, but you see when in the autumn days it gets hot, as it did last year, the temperature gets very high, and we counsel our co-operative fellows to keep their fruit at home when they can, — not to haul off too much fruit early. We have no system of cold storage yet; we are talking about it. It would be a pretty nice thing for us. We have accomplished much, and the Nova Scotia co-operative companies are the talk of all western Canada. We are way ahead of Ontario along that line, and we feel very proud that we have made such a business of it. We have a very fine secretary and a good business man. Every central office employs a manager and bookkeepers, and each co-operative company has a manager and head, and then the girls and young fellows do the packing. The apples are all sorted in baskets. The African trade requires box stuff. Think of sending apples to South Africa, 3,000 miles. We sell large quantities of fruit right from the warehouse. About all fruit sold to the Canadian west is by the carload.

Question. What is the inside measurement of your bushel box?

Mr. Woodworth. Eleven by twenty. It is a longer box than the so-called standard, but not so deep. It holds a bushel.

Question. Is it 10 by 11 by 20?

Mr. Woodworth. Yes; I think that is the measurement. Our barrel is smaller than yours. I think our barrel is like the New York State barrel.

Mr. Wheeler. This Oregon box is $10\frac{1}{2}$ by $11\frac{1}{2}$ by 18. We have no law in this State requiring any size.

Mr. Woodworth. Of course, there is a call for boxed stuff, but the majority of our trade is packed in barrels. The size of our box is regulated by the Dominion government. You will never feel happy until you get a good stiff law on about inspection; it is one of the very best things for any agricultural or any fruit-growing district. There will be a lot of kickers at first, but they will all disappear.

The Commonwealth of Massachusetts.

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CRANBERRY GROWING

HENRY J. FRANKLIN.

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CRANBERRY GROWING.

HENRY J. FRANKLIN, PH.D., SUPERINTENDENT CRANBERRY STATION OF THE MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION, WAREHAM, MASSACHUSETTS.

The cultivation of the cranberry as a commercial enterprise was begun on Cape Cod about fifty years ago. While the cranberry plant is a native of northern Europe and Asia as well as of North America, it has never been put under cultivation in the Old World. The conditions on Cape Cod appear to be peculiarly adapted for the growing of this berry, and as the business from the start was found to be profitable it developed to such an extent that it is now considered the most important industry on the Cape. It now brings in a total net return annually of between $1,500,000 and $2,000,000 to those interested in the growing of this fruit in Massachusetts. It has also been found that other sections of North America are suitable for the commercial growing of the cranberry, and it is now grown successfully in New Jersey, Wisconsin, Nova Scotia, Michigan, and on the Pacific coast line of Oregon and Washington and on Long Island, these districts being named in the order of their relative importance as cranberry-growing regions. The Cape Cod region produces annually considerably over half of the cranberries which are grown commercially, New Jersey producing over three-fourths of all the berries grown in the other sections. No very definite and accurate census of the cranberry acreage appears to be available, but the government census indicates that over 20,000 acres are under cranberry cultivation in the United States. These figures, however, do not really show how much land is devoted to the industry, for they do not include the land that is used for a variety of purposes in connection with most bogs, such as sand banks and other necessary upland surrounding the bogs and the land used for reservoirs. If all this incidental land were included with the land actually under vines, the total acreage devoted to the production of this crop directly and indirectly would probably not be less than 40,000 acres.

The average annual yield of cranberries per acre on the Cape is a little less than 40 barrels. In all the other cranberry-growing sections, except those of Washington and Oregon, the average per acre yield is very much less than this. This appears to be due partly to the superior natural conditions surrounding the industry on the Cape, and partly to the methods of culture employed — particularly with reference to the use of sand as a surface mulch. All the bogs on Cape Cod are covered with sand before the vines are set out, and they are also resanded more or less frequently after they have come to bearing. Sand is also used in a similar way in Oregon and Washington, but in New Jersey and Wisconsin only a very few of the bogs are sanded at all. Moreover, the Cape Cod bogs are, as a rule, kept almost entirely free from weeds, while in other sections the bogs are always very weedy, this freedom from weeds on the Cape being partly due to the use of the sand and partly to better care.

The following list, giving the cranberry production on Cape Cod, in New Jersey and in Wisconsin for the past few years, will give some idea of the lead that Cape Cod has in this industry over all other sections. It is the belief of the writer that the natural conditions are so superior for the production of this crop on the Cape that this lead will always be maintained, the comparative lack of suitable and accessible sand being a factor which must certainly always be a detriment to the industry in other sections. Moreover, the climate of the Cape seems to be more suitable than that of other sections, the warmer temperatures of New Jersey being apparently responsible for greater troubles with fungous diseases, and the colder climates of Nova Scotia and Wisconsin causing the berries many times to be smaller on account of the shorter growing season, and also the losses from frosts to be in proportion much greater.

Production of Cranberries.

Year.	Massachusetts (Barrels).	New Jersey (Barrels).	Wisconsin (Barrels).	Grand Total (Barrels).
1901-02, ...	240,000	105,000	40,000	385,000
1902-03, ...	215,000	30,000	46,000	291,000
1903-04, ...	204,000	168,000	18,000	390,000
1904-05, ...	226,000	83,000	21,000	330,000
1905-06, ...	146,000	88,000	18,000	253,000
1906-07, ...	240,000	103,000	45,000	388,000
1907-08, ...	284,238	121,000	21,000	426,238
1908-09, ...	229,860	75,000	12,000	316,860
1909-10, ...	372,835	165,000	30,000	567,835
1910-11, ...	287,046	241,000	16,000	544,046
1911-12, ...	273,120	143,000	30,000	446,120
1912-13, ...	317,605	112,000	45,000	474,605
1913-14, ...	338,850	100,700	30,000	469,700

This does not include cranberries not shipped over railroads and used for evaporating purposes.

Cranberries are of course essentially a luxury, but they have come into such general use, especially in connection with the Thanksgiving and Christmas dinners, that they may be looked upon as a commodity approaching the importance of a necessity, and up to the present time the widening of the market for them has so kept pace with the increase in their production that satisfactory prices almost always prevail for fruit in good condition. For several years the fear that there may come a time when the supply of cranberries will so exceed the demand as to make them a drug on the market has been present in the minds of many interested in the industry. While it must be admitted that there is a possibility that such a condition may come to pass, it must be borne in mind that there has not yet developed any considerable export trade except that with Canada and that the methods of disposing of the crop were very crude and hit or miss until within the last three or four years. Moreover, satisfactory methods for the preserving of this fruit have not yet been developed, and our knowledge of the best means for producing the fruit cheaply is probably in its infancy. It is to be hoped and expected that the development of an export trade and of satisfactory processes for preserving, the perfection of selling arrangements, the production of heavier average annual crops to the acre, by the stoppage of losses from insects and disease, and possibly also by the growing of more prolific varieties, which would lower the per barrel cost of production, will make it possible to grow cranberries at a reasonable profit and at the same time provide for a normal increase in acreage for many years to come. Better and more economical methods of harvesting, packing and shipping the fruit will also undoubtedly be developed and assist greatly in lessening the cost of production. The average expense of picking the berries and resanding bogs is at present altogether too high, and it is not unreasonable to expect that both these costs will sometime be much reduced by the use of machinery. It is to be hoped, also, that in time the sales companies of New England, New Jersey and Wisconsin, which at present, together as the American Cranberry Exchange, control the sale of over 60 per cent. of the cranberry crop of the country, will so develop their arrangements as to have large central packing plants where the process of preparing the berries for market may be so simplified and perfected that the expense connected with it will be considerably reduced.

To discuss fully all the matters of interest in connection with the cranberry industry would require more time and space than is allowed the writer in the preparation of this paper. There will be given here, therefore, only a brief discussion of what appear to be the more important essentials for the growing of cranberries, their preparation for market, and their preparation for the table, together with an itemized estimate of the present cost of preparing a bog.

The Essentials of an Ideal Cranberry Bog.

Land.

It seems to be the general experience that cranberries in cultivation, as in the wild state, do best on low, moist, swamp land consisting of muck or peat. The depth of this peat or muck soil need not, however, be very great, a few inches of peat or a single layer of turf underlaid by sand or clay very frequently giving most satisfactory results. It does not appear, however, that any muck or peat or even any sod is absolutely essential, for often portions of bogs grown on sand alone, so called "hard bottom," especially if fertilized, produce very satisfactory crops. A clay or marl soil in damp situations is often found highly satisfactory. Other things being equal, the freer the land is from brush or timber the better, for it is more easily and cheaply put into shape for growing cranberries. Fresh meadow has been frequently converted into cranberry bog without turfing, the grass being simply covered over with a good coating of sand and the vines set out without further preparation, except that of leveling and ditching, and the bogs thus made have been, in most cases, satisfactory, and they were certainly built at comparatively small expense. Brush swamps are in general to be preferred to wooded swamp land because of the smaller expense of clearing. If heavily wooded land is used, it is desirable to remove the stumps of the trees if this can be done without too great expense. It is advisable to cut the trees at the roots so that the stumps may be tipped out in felling. The stumps may be burned or removed from the bog. It is the writer's opinion, however, that much labor has been wasted on removing stumps, for it is a matter of common observation that, after a bog has been producing berries for several years, the vines are more thrifty and produce more fruit over buried stumps than on the portions between the stumps. It seems probable, therefore, that it would be wiser to cut down the tops of such stumps as are very hard to remove and cover them over.

Location.

A cranberry bog should be located on or close to a good stream of water, capable of furnishing quick flowage at any time during the year. In case the stream is of itself not sufficient, it is best to increase its capacity for flooding by building a reservoir further up the stream than the bog location. This reservoir, however, should be located as far from the bog as is practicable, and should not be kept full during the growing season any more than is absolutely necessary. If the reservoir is near the bog and is kept full all the time, it will impair the drainage of the bog and make it weedy. It is desirable that the bog should be open to the sunshine and winds instead of being surrounded by high uplands and woods, for a bog in an open location is less liable, other things being equal, to injury from frost, and its berries are more likely to set heavily, ripen early, and keep well when exposed to the maximum amount of sunshine.

Sand.

Clean sand, preferably coarse, or gravel should be readily obtainable from banks surrounding the bog location. Fine sand is often used for covering the bog with a mulch before the vines are set as well as for resanding them in subsequent years, but such sand appears always to promote the growth of moss and does not seem to be so effective in helping to keep down weeds as does coarse sand. Fine gravel is thought by many to be superior to sand.

Drainage.

A bog should be capable of good drainage. Poor drainage always promotes weed growth, and it usually affects the keeping quality of the berries by inducing increased activity on the part of fungous diseases which cause berries to rot both on the bog and in the storehouse. In order to have sufficient drainage, it is necessary that the land on the lower side of the bog should grade down rapidly, so that the water at any time may be drawn out of the bog quickly. A ditch should be cut entirely around the bog, and other ditches are usually dug across it, dividing it into sections. If the drainage away from the bog is first class, these cross ditches are not of extreme importance unless the bottom is springy. In a naturally dry and well-drained piece of bog it is desirable that the cross ditches, if present at all, should be few and widely separated. If, however, the bog is naturally wet and difficult to drain, the cross ditches should be much closer placed. In many well-drained bogs the cross ditches are probably placed much closer together than is necessary, for the reason that water is found to travel easily and quickly through ordinary peat. Its passage through peat is far more rapid than through clay soils. On naturally well-drained bogs, therefore, the chief function of the cross ditches is to provide for the rapid distribution of water over the entire bog surface, especially in the beginning of flooding. Without cross ditches to distribute the water, the flowage tends to pile up more or less at the end of the bog where the water is admitted. The marginal ditch should be 3 or 4 feet wide and 2 feet deep. One of its purposes is to prevent upland growths from encroaching on the bog. It also prevents many kinds of insects from crawling on to the bog, and it is a considerable protection in case the bog is threatened by forest fires. It is customary to have one of the cross ditches larger than the others and running lengthwise of the bog, in the path of the direct flow of water from the brook or reservoir used for a water supply to the drainage outlet. This is desirable, as it accelerates the handling and distribution of the water in flooding and draining. Such a ditch is especially desirable on bogs of large area.

Grading.

All single bog areas should be as nearly level as possible, so that they may be flooded quickly and with as small a quantity of water as possible. The grading is done after the ditches are dug, the water line in the ditches being used to grade from. If the water supply is very abundant, it is not so necessary to be particular about getting the bog surface level as it is if the supply is scanty. The material thrown out in ditching may be used to fill up the holes formed by the pulling out of stumps or otherwise. Usually it is profitable in the long run to spend considerable money and effort in getting a bog perfectly level, and no swamp ought to be selected for cranberry purposes where it is impossible to perfect such grading at a reasonable expense, unless the water supply is ample.

Dikes.

The dams made for holding the water in reservoirs and bogs in flooding are of the sort called dikes. They are usually made of a wide core of sand faced on either side with a wall of turf. This turf may often be gathered from the upland surrounding the bog, but the surface of the swamp itself usually has to be scalped after the lumber and brush are removed, and the turf thus obtained may be partly or wholly used in facing the dikes and in walling the ditches. Unless certain malignant weeds are present to cause trouble, this turf need not, however, be removed from the surface of the swamp unless it is needed for the dikes and ditches. It may be turned upside down where it is cut instead, and when thus handled and covered with the surface mulch of sand it will give no great trouble from the weed standpoint.

The dikes are of various dimensions according to the heads of water they are required to hold. It is sometimes desirable to build the dikes wider than is necessary to hold the water, so that they may also serve as roadways across the bog. In case the bog location runs for a long distance along a stream, it is best to divide the swamp into several separate bog areas, each area nearly level in itself, but the various areas at different elevations according to the lay of the land, and all separated from each other by dikes. In this way the quantity of water required for flooding the entire swamp may be very greatly reduced. The dikes should have a broad base below the center of which a trench should be dug to hardpan. This trench should run lengthwise of the dike and should be filled with sand or gravel so as to make a good connection with the soil beneath for holding the water. The dikes should be narrower at the top than at the bottom. Heavy teams should not be allowed to drive over a new dike for several months after it is built, for the dike will be injured for holding water if it is used as a roadway before it has become well settled together. A dike should be built overstrong rather than not strong enough. In other words, it is the part of wisdom to always build a dike wider and higher than appears to be necessary. It should be at least a foot higher than the high-water mark, for the wave action of the water against it will be certain to wear a hole through the top in time in case it is not high enough. Ditches should not be dug close to the dikes, but it is desirable to ditch the bog a few feet away from the base of the dike on either side. If the ditch is cut too near to the dike there is danger of the dike caving in. If the dike crosses peat or other soft land, it should be spiled with barn boards or, better still, with planks lengthwise to hardpan, in the middle. A flume for the passage of the water must be built in the dike, and too great care cannot be used in its construction. There are several different kinds of flumes. Some are built of wood, but it will pay in most cases to build them of concrete and reinforce where necessary. The covered or trunk flume is favored by some growers of experience, and it is to be said in favor of this type that, when built of wood, it will not rot out as quickly as the open flume. When built of concrete and properly constructed, the open flume appears to the writer to be preferable. The open flume should be connected with the soil beneath and with the diking on its sides by means of plank spiling, and if the head of water to be held is very great, and the soil underneath the flume is soft and sandy, it is best to use more than one line of spiling. In the writer's opinion it is better to have the flume built so that the water may be handled from the top rather than from the bottom. It will usually be found profitable to employ a man of considerable experience in flume building.

The Form and Size of the Bog.

It is the general experience that, other things being equal, bogs of small area give much better returns than do those of large area. This is due to a variety of circumstances. Long and narrow bogs are more profitable after a certain point in size is reached than are bogs of compact form. In the first place, with large bogs of compact form, the expenses connected with the care of the bog and the harvesting of the crops are disproportionately large, particularly because it takes so much more time to wheel sand out to the center of the bog and to bring the berries to the upland from the center. Then, too, all the operations connected with harvesting and with the general care of the bog call for much more tramping over, and consequent injury to, the vines on such large blocky bogs. But perhaps more potent than these circumstances leading to the diminished success of the large bog is the fact that the flowed bog fireworm (blackhead cranberry worm) is far more prevalent and destructive, other things being equal, on such bogs. This is due to the fact that the winter flowage favors the insect by driving off from the bog most of its natural enemies such as spiders and parasites, while the water at the same time protects its eggs from unfavorable and severe winter weather conditions. The natural enemies of the insect are, of course, much slower in reaching the middle portion of a large compact bog in effective numbers than they are in reaching the same part of a small bog. If, however, the large bog is a long and narrow one, practically none of the factors here mentioned are particularly unfavorable to it in comparison with the same circumstances on small bogs in general.

Varieties.

No single bog area, that is, no area flooded by the same dike, should be planted to more than one variety. Some of the more important varieties have insect and fungous troubles which are more or less characteristic or peculiarly virulent with them, and the planting of several varieties afflicted with a variety of troubles on the same bog area often complicates the possibilities for effective treatments. There is a large number of varieties under cultivation, both on Cape Cod and in other cranberry-growing sections. Other sections may have some varieties which would be very desirable for planting on the Cape. There is always, however, the danger of the introduction of new fungous or insect troubles with the introduction of new varieties. It has been recently discovered that one disease peculiar to the Wisconsin cranberry region has been, in this way, brought to the Cape. The Early Black and Late Howe varieties are the two varieties most grown on the Cape, and they are generally considered the standard varieties there. They are fairly prolific, are well known to the trade, are among the best keepers, and their vine growth is such that they can usually be readily picked with scoops. The Early Black variety, however, is of only fair quality as a berry for the table, and the Late Howe is of rather poor quality for this purpose, being among cranberries, unless picked very late, much what the Ben Davis is among apples. The Mammoth, McFarlin, Centreville, Matthew, Centennial and Berry Berry varieties are all fancy berries and of good quality for the table, but they are, as a rule, poor keepers. Many think the Berry Berry has the best flavor of all the Cape berries at present under cultivation, and this opinion is perhaps justified. Some of the less known varieties are of fair promise, and should probably, in the opinion of the writer, be given more extended trial. The McKinley, Perry Red and Pride are here suggested as such promising varieties. The Pride is the most prolific variety of cranberries known to the writer, and it has fair table and keeping qualities and is a rather handsome berry. Its vine growth, however, is such that it will always be a difficult variety to pick with scoops.

The different varieties vary greatly in the time of ripening, the earliest usually becoming well colored by the end of the first week in September, and the latest by about the 1st of October. Some berries color up fairly well in storage, while others will not turn red very much unless they are left upon the vines. Cranberries are first green, then almost white, then pink, and finally red. There are some wild berries which are milk white when ripe, and some of the varieties under cultivation, such as the Early Black, when completely ripe, are so dark red that they are almost black. The berries of the different varieties vary greatly in shape, some being pear shaped, others elongate and pointed, and still others oval and round. Other things being equal, the round berries are to be preferred, for they are the most easily cleaned and are, therefore, most cheaply prepared for market, and will, as a rule, be shipped in the best condition.

The Construction of a Bog.

Sanding.

The first operations in the preparation of a cranberry bog, namely, the cleaning of the land of timber and brush, the turfing, the ditching and the grading of the swamp, have already been discussed sufficiently for present purposes. After these operations have been completed the swamp is ready for sanding. In this there is a variety of practice. On Cape Cod, where the sand is plentiful in banks adjoining the swamps, it has always been carried on to the bogs by men with wheelbarrows, over lines of planks. This is necessarily an expensive process, and it seems probable that it will eventually be replaced by some method of pumping, as pumping would be much cheaper and is already practiced as a means of handling sand in other similar connections. In the Pacific northwest, where the sand underlies the swamps and is not available in quantity in banks close to the bogs, some growers have successfully followed the practice of pumping up the sand in the water from the bottom with a centrifugal pump, and sending it through long lines of piping to the place where it was to be used. They have pumped sand in some cases for over a mile in this way, the cost of sanding by this method being less than $30 an acre. In former years, those who built bogs on the Cape considered it necessary to put on 5 or 6 inches of sand before planting, and this practice still prevails with many growers to-day. Those of largest experience, however, appear to have generally adopted the idea of sanding more lightly before planting, and they, as a rule, now put on only from 2 to 3 inches of sand. With this smaller amount, the vine growth is distinctly more rapid after planting, the bog becoming more quickly vined over and consequently reaching full bearing sooner. If this practice is followed, the bog should be resanded with from a quarter to a third of an inch of sand every year for the first three or four years after planting. By this method of procedure, however, a firmer and more deep-set root system will be obtained, and the bog will be kept in the best condition possible for scooping.

The sand serves several purposes: it helps to keep down weeds and moss; it fastens down the runners and enables them to root better; it gives the roots a medium to grow in which is capable of far better drainage and aeration than is peat, and thus promotes their greater development; it takes in more heat during the day than peat, and radiates it at night so as to afford a considerable protection from frost; it is a considerable aid in controlling some injurious insect pests. As the roots come to form a very dense growth in the sand over the peat, they may be said to become soil bound from time to time, and resanding gives them more soil to develop in. It has the disadvantage, however, of promoting fungous disease development more or less. It is, undoubtedly, for this reason that berries frequently rot badly on the vines in new plantings on the Cape. Berries from new plantings are generally considered weak and unfit for long shipments. Experience appears to have shown the New Jersey growers that in their climate most bogs cannot be sanded without danger of disastrous trouble from fungous diseases. On the Cape, however, if new bogs are badly diseased during the first few years after planting, they, as a rule, largely recover from it if they are kept well drained, and the advantages obtained from sanding and resanding are so great that they much overbalance this single disadvantage.

Vine Setting.

After the sanding has been done the bog is in readiness for the setting of the vines. It should be marked for planting in hills by drawing a hand-marker across it, first lengthwise and then crosswise, the marker being provided with five or more teeth. The vines should be planted in hills from 10 to 18 inches apart. About 12 inches seems to be the distance at present commended by general experience. The closer the vines are planted the sooner they will, other things being equal, come into bearing. The vines should not be bunched in the hill when planted. One or two vines are just as successful in producing a desirable growth as are half a dozen. If a lot of vines are planted in a bunch, most of those in the center, as a rule, die anyway, the result being a waste of planting material. A better method from the standpoint of vine growth, though not from the standpoint of labor involved, would be to plant several vines in each hill, but have the hill scattered, that is, have the vines separated from one another slightly in the hill. It is not necessary to set the vines right side up, for they will grow either way. The vines, after planting, need not stick up more than half an inch above the sand. A wooden or iron dibble may be used to press them in. They should be inserted well into the sand, but need not reach into the peat beneath, for most of the roots that they put out will be formed in the sand in any case.

Care of the New Bog after Planting.

Immediately after planting, the water should be turned on and held close to the surface for a day or two. This will wet up the vines and settle the sand around them. Then the water should be drawn out to the bottoms of the ditches. Except in case of very prolonged drought, a bog need not be reflowed again during the first season, and if it is reflowed it should be for only a few hours, or only enough to just wet up the surface.

New bogs should not be submerged for the winter until night freezing becomes severe enough to show signs of heaving the plants. When considerable ice forms in the ditches it is time to put on the winter flood. This should submerge the vines for several inches. In some seasons a sufficient heaving of the vines to cause considerable damage may take place as early as the 1st of November, and it is necessary to keep rather careful watch of the new planting in order to guard against this. The results of a slight injury from heaving in the early fall may not be apparent at the time, and may not, in fact, be noticed at all until the middle of the following summer, when, during a prolonged dry spell, the plants come to need a considerable amount of water. Some of the roots having been broken by the heaving of the fall before will then be unable to supply what is required of them, and a dying back of the tips, especially of the runners, will be likely to occur. In the spring, during the first three or four years, the winter flowage should be removed from a new planting about the 20th of April. At times of sudden thaws or of heavy rains, in winter or early spring, care must be taken to allow the surplus water to escape. If this is not done, and the flowage is so shallow that the vines have been frozen into the ice, the raising of the ice by the water may pull young vines out of the ground. More weeds grow on a bog during the first two or three years after planting than afterwards, for the vines have not, at that time, sufficiently covered the bog to successfully compete with them. If, however, the bog is kept free of weeds during its early youth comparatively little trouble will be experienced with them after it comes to bearing. The grower should come to understand in a general way the characteristics of the weeds with which he has to deal at this time, for it is sufficient to merely cut off the tops of some kinds and so prevent them from seeding, while it is absolutely essential that others should be carefully pulled up and rooted out. Moreover, many upland weeds, which will be entirely killed out by the winter's flooding, frequently appear on new plantings, and these need not be given any attention. After the bog has come into bearing, all weeds should be removed by the time the vines are in bloom, and if certain weeds, such as sedges, rushes, cotton grass or cut grass appear in abundance later, they should be again cleared out, even though considerable injury is done in the process of weeding. Any weeding, however, done later than the 10th of August is, to say the least, an extremely poor expenditure of time and money.

The new bog should be resanded at least twice before it produces its first full crop, so that the runners may be caused to root as they are produced each year and the vines thus develop a strong root system and become well anchored.

Care of a Bearing Bog.

After the third year the care of a bog should follow, in a general way, the following lines of practice:

The Use of Water.

The winter flowage should be put on as late in the fall or early winter as possible without running serious risks of winter-killing. As a rule, it is best not to put on this flowage until after the first heavy snow storm. This often does not occur until well into January, though the weather may become so severe as to necessitate flooding before the middle of December. In the spring, the flowage should be taken off as early as the 1st of April every other year, but it should be held as late as the 20th of May in seasons which appear to promise bad fruit-worm injury. It being difficult, however, from our present knowledge to forecast such injury, it is probably best to hold the water of the winter flood late every other year, at least in locations where the fruit worm is usually destructive. Some time during the first week in June the bog should be reflowed as a special precaution against the attacks of the fireworm, and also to clean it from any other pests which may be present in small numbers. This reflow prepares it to go through the season with a somewhere near even chance of keeping free from miscellaneous insect troubles. This reflow should, as a rule, be maintained for forty-eight hours. It should be put on during the night, and also, if possible, taken off entirely during the night, for if the tender, growing vines stand partly covered with water and exposed to the sun for any length of time they are likely to be injured by scalding. In case the winter flowage is taken off late, and the season is also cold and late, this June reflow should probably, as a rule, be postponed to some time during the second week of the month.

If frost threatens to do damage during May or the first half of June, it will be necessary to put on a partial flood for protection against it. It is not necessary, however, to entirely cover the vines for frost protection. Two or three inches of water over the surface of the sand under the vines is entirely sufficient for this protection, as the water will radiate its heat into the air and maintain a sufficiently high temperature around the vines to keep them from freezing. Bogs are flooded both by gravity flowage and by pumping. With many bogs, however, there is not sufficient water supply for reflowage or even, in some cases, for winter flowage. On such bogs, if they are not located in exceptionally cold places, protection from frost may be had at reasonable expense by the use of tobacco shade cloth.

The bog should not be reflowed during or after the blossoming period except in cases of extreme need, such as protection from a forest fire or a threatened insect devastation which evidently could not be averted in any other way. In September and October the fall period of frost danger often makes it necessary to again flow the bogs for protection. The berries and vines will, however, endure some frost at this period of the year, and longer chances may be taken than during the spring period of danger. It is not desirable to flood in the fall for protection if it can be avoided, for the water tends to cause a deterioration in the keeping qualities of the fruit. It should be stated, in this connection, that it is best not to flood for frost protection either in the spring or fall unless it is certainly necessary, for the water at either period of the year will do a certain amount of harm. The United States Weather Bureau maintains a frost-warning service for the benefit of the growers during both of these periods, and warnings may be had from the office in Boston when they are needed by any grower if he has a telephone and will make his wants known. It is not wise, however, to always rely absolutely on this service, but most growers could save their bogs from many a flooding, and at the same time save their water supply to meet their greatest needs when such supplies are not abundant, by making a more careful study of weather conditions, especially in connection with the dew point and the action of the barometer.

After the crop is harvested, the bog should be completely reflowed for five or six days. This helps the vines to recover from the shock of the tearing up which they receive during the process of harvesting. It also destroys whatever girdler worms may be present on the bog, if the water is put on before the 1st of October. No reflowage after this one is necessary or desirable before the water is put on for the winter.

Irrigation.

There is a variety of practice in connection with the irrigation of cranberry bogs, and it is by no means certain what the best practice is. A bog can be given altogether too much water during the growing season, and most growers probably err more in this direction than in running their bogs too dry. It is evident, however, that in periods of prolonged drought a bog can be run so dry as to cause it injury. In case of doubt, it is probably best to take a middle course and try to be sure that the vines have enough water but not too much. If the sand is moist up to within half an inch of the surface, even though the surface itself appears perfectly dry, it is pretty certain that the vines have all the water they need, even if the water table appears to be very low.

The Use of Sand.

Experience and investigation seem to indicate that resanding should be done every other year on a bearing bog. The oftener it is done the more of a protection it is against frost, the girdler and the tip worm. If it were not for these three factors, it would probably not be desirable to sand oftener than once in three years. There is a difference in opinion in regard to the best season of the year for sanding. Some, with the writer, hold that the fall, after harvesting is done, is the best time for this work. Others consider that the sand may be applied most cheaply, evenly and effectively on the ice during the winter. Still others believe that it is best to sand in the early spring after the winter flowage has been let off. Sanding may sometimes be done most cheaply in the winter, although weather conditions would affect the cost. Certainly the process of sanding will do the least possible mechanical injury to the vines if the sand is put on the ice. This mechanical injury is undesirably great in the spring, but the sand is, of course, somewhat cleaner for the following season if it is applied in the spring. There is usually, however, not so great a rush of work in the fall as in the spring, and labor is, therefore, usually more abundant, and better attention can be given to the work at that time of the year. Moreover, the injury done to the vines at that season is not very great. The cost of thorough resanding with from a quarter to a third of an inch of sand varies from $20 to $30 an acre.

Pruning.

Sometimes vines become undesirably thick and dense. This may be due to a variety of reasons. It most often occurs on new bogs where the bottom is very rich and the sand mulch comparatively thin. Under such circumstances it is probably best to thin out the vines by the use of knife-rakes and then sand the remainder heavily. With the exception of this treatment for the improvement of heavy vine conditions, pruning as a general practice on cranberry bogs is probably not to be recommended. It is sometimes desirable, however, to thin out loose runners by a very light use of the rakes.

Fertilizing.

Extensive experiments with fertilizers have been carried on for several years, but it has not yet been definitely proved that there is any great advantage to be had from their use from the standpoint of fruit production. There appears to have been no decided increase in the quantity of fruit due to the use of fertilizer, except where some form of nitrate has been used, and in this connection it is probably safe to recommend for many bogs the use of nitrate of soda in moderate quantities (100 pounds to the acre). The best results from the use of this fertilizer are to be expected on portions of the bog which for any reason are thin vined, especially on the portions over "hard bottom" (sand or clay underneath instead of peat). Such fertilizing on new bogs is probably entirely undesirable except on "hard bottom." Vine growth is always accelerated by the use of nitrate, and this acceleration is likely to be undesirably great on peat bottom, especially if the bog is new.

Fungous Diseases.

There are numerous fungous diseases which affect cranberry vines. Some of them seriously affect the vitality of the vines and some reduce the crop either by blasting the blossoms and young berries or by causing the decay of the larger berries both on the vines and in storage. As has already been indicated, the use of sand encourages the development of such diseases, but it is so great a help in other directions that it must be used in spite of this difficulty. One of the best ways to reduce trouble from fungous disease is to maintain good drainage during the growing season. For this reason, bogs which are troubled seriously by such diseases should be kept as dry as they safely can be throughout the summer, after the winter flowage has been taken off. It seems to be the general experience on the Cape, however, that late holding of the winter flowage (to the 20th of May) markedly improves the keeping quality of the berries. Care in the handling of the fruit during the harvesting, and in the processes of separating, screening and packing for the market will certainly do much to keep down the rotting caused by fungous diseases during transportation. The matter of spraying bogs for the curtailment of fungous diseases is, at present, in a condition of confusion. It is found that Bordeaux mixture, made according to the formula which is used in New Jersey, and which has been recommended by the experts of the Bureau of Plant Industry of the United States Department of Agriculture, apparently causes a cumulative injury to the root system of the cranberry when used on Cape Cod. It is to be hoped that some modification of this formula will in time be found which will not cause this injury, and which can be safely used to keep down fungous diseases on the Cape bogs. Spraying is found to be uniformly successful in improving the keeping qualities of the berries and in reducing the rot on the vines.

Insect Pests.

There are several serious insect pests which affect the cranberry. The more important are the following: the fruit worm, the flowed bog fireworm (blackhead cranberry worm), the tip worm, the girdler and the dry bog fireworm (yellowhead cranberry worm). These pests are here named in the order of their apparent importance. The first two are by far the most important. The fruit worm alone has been known, in some seasons, to destroy as much as an estimated third of the entire Cape crop. The only certainly efficient remedy for this insect at present known is late holding of the winter flowage in the spring (to the 20th of May). It is not desirable, however, to practice this late holding every year on account of its effect on the vines, and it is therefore recommended that this flowage be held late every other year as a regular preventive practice against this insect. The flowed bog fireworm never attacks strictly dry bogs seriously, and it may be prevented from developing a serious infestation on any bog with an abundant water supply by means of an annual June reflowage, as already recommended in another place. On large bogs which can be reflowed, but on which the reflowing is not regularly done on account of the impossibility of handling the water quickly, it is probably best to follow the practice of compelling the eggs of the insect to bunch up in their hatching, by holding the winter flowage late (to about the 1st of June), and then reflowing about three weeks later. On bogs which are winter flowed, but cannot be reflowed at all, spraying with arsenate of lead is, at present, the only remedy which can be recommended without qualification.

When very abundant, the last brood of the tip worm can do serious injury by reducing the bud formation from which is produced the crop of the following season. Investigations seem to have indicated that ordinary resanding, if done frequently enough, is a satisfactory preventive of trouble from this insect. On this account it is recommended that resanding be done every other year.

As already indicated, reflowing after picking is a satisfactory method of treating the girdler where water is available. This insect will not get in, as a rule, on bogs which cannot be reflowed, if they are kept well sanded. It seems to like to work in the rubbish of an unsanded bog in thick vines. If a serious infestation is already present, resanding evenly with a full inch of sand either in the fall or in the spring before the first of June is usually sufficient to smother the insect so that the moths will not emerge.

The dry bog fireworm is easily controlled by a single spraying with arsenate of lead, applied between the 4th and 10th of July. On the Cape this insect seriously affects only such bogs as are not winter flowed.

Harvesting.

In average seasons the cranberry harvest begins during the last week in August and continues until the crop is entirely gathered. The length of the picking season varies greatly in different years, according to the weather conditions. Cranberries should be picked only in dry weather. It will not do to begin picking in the morning until the vines have thoroughly dried off, and the day's picking must be finished before the dampness of the very late afternoon begins to gather. Frosty nights, as well as wet weather, are a hindrance in the picking season, for they compel the flooding of unpicked areas and, as a rule, no picking can be done on the day following flooding. Cranberries were originally picked entirely by hand, and quite an army of pickers was needed to gather the crop. With the acreage at present under cultivation it would be practically impossible to gather the entire crop by hand on account of scarcity of help. There is, however, considerable hand picking still done, especially by the small growers. If berries are picked carefully by hand, this method probably causes the least possible injury to the vines. It is, however, a very expensive and probably unwise method to follow, except, perhaps, on the thin vines of new plantings, the berries of which are likely to be tender and should be injured as little as possible.

Most of the crop on Cape Cod is, at present, picked with rakes, or scoops as they are more commonly called. Scooping is also largely practiced in Wisconsin. Hand picking, however, is the rule in New Jersey. With average crops, berries may be gathered with scoops at an average expense of from 40 to 50 cents a barrel. With very heavy crops, berries have occasionally been scooped for as little as 9 cents a barrel. They can hardly, however, be gathered at so little expense, even under the most favorable conditions, without great waste, too large a percentage of the fruit being left on the bog under the vines when the scoopers are rushed, especially when the crop is heavy. There is a general tendency among the growers to hasten their pickers, with the idea of harvesting at as small an expense as possible. This tendency, however, is to be deplored, for the old saying that "haste makes waste" has no more appropriate application than in this matter of picking cranberries with scoops. The scoopers should be made to work rather slowly, especially if the crop is heavy. To have the men work steadily, without haste, and scoop with as little waste as possible, without picking up by hand any of the berries that fall to the ground, is probably a good rule to follow. On large bogs, if help is scarce, it is, however, probably best to harvest the crop as rapidly as possible so as to save it from frost damage, even though the waste is great. Prevailing prices also have a bearing on the comparative wisdom of slow and rapid scooping; $3.50 a barrel net would justify rapid scooping in any case, but $4 or more net makes slow, careful work desirable. The berries that fall to the bottom and are left on the bog should not be gathered by hand, for they will not sell for enough to pay the expense of handling. They are always in poor condition, having been tramped over more or less, and are certain to decay badly if gathered. Such berries are sometimes gathered from the water when they float up on the after-picking reflow. Only a small portion of what is left on the bog will, however, float up in this way, and if they are gathered, it is almost an endless job to get them dry and keep them so. In general, therefore, it is probably best not to bother with such berries at all.

Women and children help freely in hand picking, but only men should be engaged for the heavy work of scooping. It is probably best to pay the scoopers by the hour, without attempting to hasten their work by means of bonuses for extra quantities picked. The usual wage for scoopers is 35 cents an

Cranberry scooping. At this spot there were two barrels to the rod, and twenty men picked five hundred barrels in five and one-half hours.
(Published by permission of the United Cape Cod Cranberry Company.)

hour, though the larger growers are sometimes able to hire them for as little as 25 cents.

Small hand-picking machines, known as "snap machines," are frequently used for gathering the berries on thin vines instead of picking by hand. These are very useful, for they gather the berries comparatively quickly and cheaply and without much injury to the vines. They do, however, injure the fruit more or less seriously and impair its keeping quality.

Marketing conditions are such, and the possible harvesting period is so short, that it is probably necessary, especially if the season is late, for many growers to begin picking while the berries are still partly green. Many believe that very ripe berries will not keep well, but it is to be seriously questioned whether they will not keep as well on the vines, if they are protected from frosts, as they will in the screen house. Between the 1st and the 15th of September, during the period of coloring, berries of the Early Black variety will increase 10 per cent., and sometimes more, in size. They make a much more attractive appearance and are of much better quality for the table after they have become colored. Probably many growers would, therefore, be wise to postpone their picking for two weeks later than is their present custom. Early Blacks for late shipment should probably not be picked before the first of October, for late picking would largely prevent the loss by shriveling, which is usually considerable if the berries are picked early, and then held in storage for some time.

Berries which grow on vines bordering the ditches are generally considered to be, as a rule, poorer keepers than those from the other vines. These "ditch row" berries, as they are called, should, therefore, be gathered first, and be packed and shipped separately from the rest of the berries. It would probably be a good practice to devote the first day of picking to the gathering of all the "ditch row" berries of the early varieties on the bog to be picked. They would then be out of the way, and it would be unnecessary to keep further track of them.

To harvest a 15-acre bog, 15 scoopers, a foreman and three helpers are necessary. Two of these men are engaged in taking the berries off from the bog and piling them up in boxes on the upland where they may be taken away by team. An ideal way to remove the berries from a bog is yet to be devised. Hand barrows or stretchers are probably most commonly used, and this method is fairly satisfactory, but it seems expensive. Ordinary wheelbarrows are often used, both with and without planks. The trouble of moving the planks, however, is considerable, and if they are not used, the vines are likely to be killed out more or less in paths by the constant rolling of the wheelbarrows over them, for it is very difficult to keep the men who are wheeling the berries from following paths. Probably some form of hand truck might be devised which would give better satisfaction than anything at present in use for this purpose.

As they are picked, the berries are dumped into bushel boxes on the bog, the slats of the boxes having more or less space between them to allow for a circulation of air through the berries which they contain. As the scoops gather more or less vines, these are dumped into the boxes with the berries, no great pains being taken to clean them out. It is generally supposed that the berries keep better in storage if a considerable quantity of vines and chaff are allowed to remain in the boxes with them, the idea being that the vines increase the possibilities for air circulation. It seems very doubtful, however, whether the presence of the vines has this supposed effect to any considerable degree, and it is certain that no conclusive tests have been made which prove any such effect. Probably this idea sprang from the fact that, after berries have been run through the separator and screened they decay comparatively rapidly in storage. This deterioration in keeping quality is, however, evidently very largely due to the injury the berries receive during those processes of cleaning. After harvesting, the vines should all be raked hard in one direction with ordinary hay rakes. This raking clears the bog of loose vines left torn up by the scoops and it trains the vines that are left for scooping the following year.

Screen House.

After being poured into the bushel boxes, the berries are stored in the packing house (screen house). This building should be capable of thorough ventilation. On damp days it should be kept close shut, and on dry, sunny days it should be thoroughly ventilated. It should have ample capacity for storing two-thirds of the maximum crop that may be expected from the bog and the barrels for packing as well as room for separating and screening the berries. A building of one floor, 40 by 80 feet, should be sufficiently large to accommodate the berries of a heavy crop from a 12-acre bog.

Preparation of the Berries for Market.

The first shipments are usually made within a week after picking begins, in early September, and the greater part of the crop is sold by the 1st of December, though a considerable quantity of berries is often in the hands of the growers until well into the winter. Some growers prefer to take the lower prices which the earlier shipments bring and get rid of their berries as soon as possible. It is to be said in favor of this attitude that their shipments do not suffer from shrinkage due to rot and loss of water as do the late shipments, and the cost of screening and packing is also much less than it is with the berries which are shipped late. Berries which are held until into the winter, however, usually bring much better prices, and some growers prefer to hold their fruit late and suffer the incidental losses for the sake of obtaining these higher prices.

In preparing for market, the berries are first run through a machine known as a separator. There are a number of makes of these machines on the market. Those most used on Cape Cod are provided with a hopper at the top for receiving the berries, a blower for cleaning them of chaff, and several bounding boards for separating the decayed from the sound fruit. Some of the machines also have other useful accessories, such as endless aprons and grading devices. If the berries have not been badly worm-eaten or decayed on the bog to any extent they may be packed for shipping as soon as they have been put through the separator, and the early shipments are often handled to a considerable extent in this way. Most of the berries, however, have to be screened by hand after they have been run through the separator. Women are employed to do this work, and there is a variety of makes of screens for this purpose. "Screeners" are usually paid $12\frac{1}{2}$ cents an hour for their work.

It is best not to screen or pack fruit on wet days, for the berries are likely to absorb moisture on such days, and if they are packed moist they are far more likely to rot in transportation. Most of the berries are packed in barrels of standard dimensions which are guaranteed by law to contain a certain amount of fruit by weight. These barrels should contain approximately 85 quarts each. Bushel crates are often used satisfactorily in making small shipments. If barrels are used they must be shaken and well pressed down in the process of heading so that they may not be found in the market to be "loose packed." "Loose packed" barrels are shunned by the trade, both because of their lack of a full quantity of fruit and because the thrashing around of the fruit in a loose pack seriously impairs its keeping quality.

Marketing.

According to conditions, the opening price of cranberries in the fall ranges from $4.50 to $5.50 a barrel. About 60 per cent. of the Cape crop is sold through a co-operative selling agency known as the New England Cranberry Sales Company, with its office at Middleboro, Massachusetts. Other sales companies in Wisconsin and New Jersey, affiliated with the New England company, handle the greater part of the berries grown in those sections. This selling agency is now well organized and managed, and it helps the trade tremendously by keeping track of the cranberry situation and markets in different parts of the United States and Canada and distributing the berries as they are needed, thus preventing gluts in the market as far as possible. It maintains a corps of inspectors, and the berries handled by it are packed uniformly, under different brands, according to their varieties and qualities, a stability in the selling arrangements being thus maintained all the way through.

Many growers, however, prefer to be free to sell their berries without any dictation as to packing and marketing. Most of the fruit sold by growers outside of the sales companies is probably disposed of through commission men, and there are buyers for cash also on the ground, more or less, every year.

Preserving.

Various efforts have been made by some of the larger growers to preserve the fruit which cannot be immediately placed on the market. Methods of canning and evaporating have already been considerably developed, and preserving in one of these ways is likely, in time, to become an established part of the business. As a matter of interest to housewives, it should be stated here that cranberries can be kept fresh and in good condition for several months by keeping them submerged in cold water in sealed jars in a cool place. It is important to wash the fruit thoroughly and sort out the decayed berries, before the fruit is thus submerged.

Cooking.

Cranberries should always be cooked in earthen, agate or aluminum kettles. The strong acids of this fruit act so quickly upon tin, iron or brass that kettles made of these metals should never be used. Cooked cranberries should not be allowed to stand in dishes made of metal which their acids will affect. Only granulated sugar should be used to sweeten this fruit. There is probably a considerable difference in the quantities of sugar required to sweeten the fruit of the different varieties. The riper the berries are when picked the smaller the amount of sugar they are likely to require.

A few recipes which have been found particularly good for the preparation of cranberries for the table are here given. These recipes are from a handbook published by the New England Cranberry Sales Company.

Sauces.

No. 1. — Take 1 quart of cranberries, 1 pound of sugar, 1 pint of water. Boil sugar and water together for five minutes; skim; add the cranberries and cook slowly, without stirring (turn and shake the pan if necessary), until all the berries have cracked their skins, and so become sweetened. Remove from the fire when the popping stops.

No. 2. — Take $1\frac{1}{2}$ cups of boiling water, 1 quart of cranberries, $1\frac{1}{2}$ cups of sugar. Boil together for fifteen minutes without stirring, but watch carefully to prevent burning (shake and turn the pan, if necessary), the object being to preserve the fruit as nearly whole as possible.

No. 3. — Take 1 quart of cranberries, 1 pint of sugar, 1 pint of water. Put berries and water in a pan and spread the sugar over the floating berries; cover closely and cook for ten minutes without stirring. Do not let them burn or boil over; shake and turn the pan occasionally. Skim with a silver or porcelain spoon, and set back on the stove to simmer for a few minutes. Cooked in this way the skins will be tender, the berries nearly whole but sweetened, the juice clear and almost a jelly.

Jellies.

No. 1. — Take 2 quarts of cranberries, 1 quart of water. Boil until the cranberries are tender. Strain through a jelly bag or thin muslin. Heat the juice, and to each pint of juice add from $\frac{3}{4}$ of a pound to 1 pound of granulated sugar, according to taste. Stir until the sugar is dissolved, but do not boil. Pour into jelly glasses or molds.

To make a firm jelly, boil a quart of berries with $1\frac{1}{2}$ cups of water until the skins burst. Press through a sieve and reheat. When at the boiling point, add 1 pint of sugar and boil for ten minutes, then turn quickly into wet molds.

No. 2. — Wash 1 quart of selected berries. Sprinkle over them 1 pint of sugar and $\frac{1}{2}$ pint of water. Cook slowly. When they begin to boil, cover over a few moments and cook until tender, but do not allow the skins to break. Pour into a mold. The juice will be firm, inclosing the berries, which makes an attractive and delicious dinner accompaniment.

Pies.

No. 1. — A delicious pie is made of $1\frac{1}{2}$ cups of split raw cranberries, 1 cup of sugar, $\frac{1}{2}$ cup of water. Put into porcelain-lined vessels and cook ten minutes. Cool and bake in one crust with a rim and strips across the top. This may also be cooked with rich upper crust if desired.

No. 2. — Take $1\frac{1}{2}$ cups of cranberries, $\frac{3}{4}$ cup of seedless raisins, 1 cup of granulated sugar, 2 tablespoons of flour, 1 teaspoon of vanilla, and a few drops of almond flavoring. Bake with two crusts. It is better to cook berries in water a few minutes.

No. 3. — Take 1 cup of split, raw cranberries, $\frac{1}{2}$ cup of seeded raisins chopped fine, 1 cup of granulated sugar, 1 tablespoonful of flour, very heaping, 1 teaspoonful of vanilla. Use a short pie crust and bake slowly.

Water Ice.

Boil 1 quart of cranberries in 1 pint of water until the skins are soft, and strain through cheesecloth. When cool, add the juice of 2 lemons. Make a syrup with 1 pint of granulated sugar and ½ pint of water; when cool, add to the cranberry juice and freeze.

Many persons add 1 tablespoonful of gelatine which has been soaked ten minutes in ½ cup of cold water.

Punch.

Boil 2 cups of water and 1 cup of sugar together fifteen minutes; boil 1 pint of cranberries and 1 cup of water together five minutes, strain through cheesecloth, add the syrup and juice of a lemon, cool, freeze to a mush, using equal parts ice and salt; serve in glasses.

The Cost of Building a Cranberry Bog.

Cost per acre for land,	$10 to $100
Clearing, ditching, turfing, grading and sanding,	200 to 500
7 barrels vines at $3 per barrel,	21 to 21
Setting out of vines,	16 to 16
Incidentals (tools, dikes, flumes, buildings, etc.),	150 to 250
Total,	$397 to $887

The cost of building will depend on a variety of circumstances, but particularly on the natural conditions, make-up and location of the swamp which is to be converted into bog, and on the ability and knowledge of the foreman who superintends the work. An average yearly yield of from 50 to 65 barrels of berries per acre may be expected from a good piece of bog, properly built and located, planted with standard varieties and given proper care.

A good bog, planted with standard varieties and given proper care, barring the accident of fire, ought to bear crops more or less regularly for a long period of years. There are bogs now forty years old on the Cape which are still in fine condition and bearing well.

The Commonwealth of Massachusetts.

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THE HOME VEGETABLE GARDEN.

ALLEN FRENCH.

FROM THE SIXTY-SECOND ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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THE HOME VEGETABLE GARDEN.

ALLEN FRENCH, CONCORD, MASSACHUSETTS.

Home vegetable gardening is in sharp contrast to market gardening. The latter needs, for success, special knowledge, very good soil and easy access to market. The former can be made successful on any farm or in any garden. Not that a weedy, poorly planned, badly fed garden is ever worth keeping, but the man who understands the worth, to his family, of a copious and varied supply of fresh vegetables can easily prove the truth of the claim made in the Farmer's Bulletin bearing the same title as this article: —

> The statement can safely be made that a well-kept garden will yield a return ten or fifteen times greater than would the same area and location if devoted to general farm crops. A half acre devoted to the various kinds of garden crops will easily supply a farm with a hundred dollars' worth of vegetables during the year, while the average return for farm crops is considerably less than a tenth of this amount.

This article proposes to discuss briefly the management of such a garden.

The size of the garden will necessarily vary with the needs of the family. Personal tastes will lead to the inclusion or exclusion of different crops. Some families eat more largely of vegetables than others. Further, some housekeepers have learned with how much ease and satisfaction vegetables may be canned for the winter, and will consequently demand a larger summer supply. It seems safe to say, however, that exclusive of the potato supply, which usually comes from another part of the farm, a half acre is plenty for a large family. Yet if the family goes in largely for asparagus, especially for canning as well as eating fresh, the half acre will have to be considerably added to.

The location of the garden is important. To begin with, it should be permanent, as only thus can it be made, by repeated enrichings, to attain the highest degree of fertility. It should have a southerly exposure (southeasterly is better than southwesterly, but due south is best of all) and should have its rows running south (as thus the plants get the sun on both sides during the day). It should be conveniently near the house for tending and picking, especially since the latter is often done by the women of the family. The garden should also be convenient to the water supply. The question of soil, should there be a choice upon the farm, is also of importance. Any soil can be improved, but the gardener should seek to get a deep medium loam in a location capable of drainage, if that is needed. A slight surface slope is usually sufficient to make drainage unnecessary, provided there is not a clay subsoil.

This study of the soil gives basis for the plan of yearly improvement. If the soil is too light manure will add humus. If the soil is too heavy manure will open it up. If it is not rich enough manure will make it richer; and once enriched manure is needed for maintenance. Therefore — manure ! But in addition to this improvement the soil can be deepened by yearly working up a little of the subsoil, and where drainage is necessary there is only yearly loss by delaying it.

Where enough manure is not to be had the richness of the soil may be maintained by yearly setting aside a part of the garden, — if possible a third, — for the growing of a green crop, preferably a legume, for plowing under. And as autumn approaches, any part of the garden that is cleared for the rest of the season should be planted with a cover crop, such as clover, vetch or rye, for plowing under.

Such individual treatment of small patches means, of course, that the owner recognizes the garden to be the most valuable part of his farm, and accordingly worth the trouble.

Land for the garden is best broken in late fall. It should be plowed, and the sliced earth left on edge for the frosts to penetrate deeply. Perennial roots are more easily killed when their roots are exposed, and the ground is made more mellow for spring working. Further, insect pests are turned out of their winter refuge and are killed. If broken in spring the sod should be turned under deeply. Spring enrichment should consist of manure, as well rotted as possible, and thoroughly disked in. In an old garden coarse manure should be plowed under in the fall. But rather than plow coarse manure under in the fall with new ground, keep the manure over winter and cure it by frequent turnings.

As a good system of accounts is the best guide to success in farming, the account book should be begun with the first fall working. Labor should be debited in a separate column at current rates, the manure and fertilizer also. Other debit columns should be for seeds, plants, chemical fertilizer and tools. A fair estimate of yearly expenses is not gained, however, especially when starting a garden, unless the tools are entered in an equipment account, only one-fifth of their cost being charged per year, on the theory that any good tool will last for five years, and by that time will have paid for itself. Credit columns will be few, but care should be taken to credit the garden with everything taken from it at current prices.

It is not to be supposed, after breaking the land in the fall, that no more work of gardening is to be done until spring. Indeed, the most important work of the garden is done in the winter, — the planning; for if the soil into which so much money is to go is not cropped to its last available foot there is waste, and this cannot be prevented except by planning. No man can go out to his freshly plowed garden, cast his eye over it, and plant it offhand in the best way. This work should be done on winter evenings, with paper and ruler and pencil, and with seed catalogues at hand. The dimensions of the garden should be exactly known. The best sort of paper for planning is called cross-section paper, ruled in small squares of about an eighth of an inch. With one of these to every foot the garden is easily mapped to an exact scale. Remember that long rows are the easiest to care for, as there is less turning, and this is an advantage where horse or wheel hoes are used.

On one side of the garden, with rows running north and south, should be put the perennials, asparagus and rhubarb. Forty to 50 good asparagus plants, when bearing well, should produce a bunch a day. Set them 4 feet by 18 inches. Four to 6 rhubarb plants are enough for most families. Set them at the end of the asparagus rows, 4 feet by 4 feet.

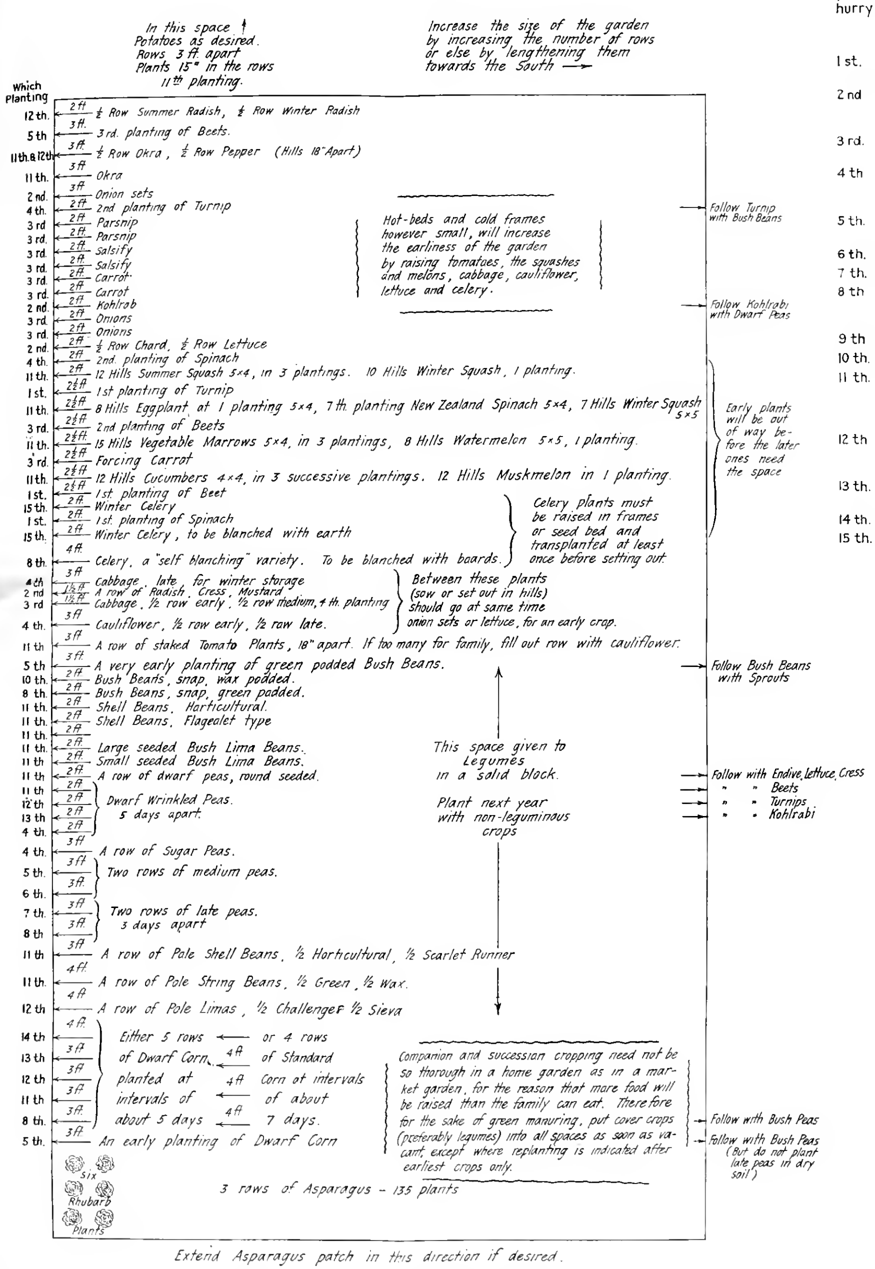
Annual vegetables fall into two kinds of classes: long and short season, and hardy and tender. According to these classifications must the garden be planned, in companion or succession or whole-season planting. Companion cropping means the planting of short-season with long-season crops, the former to be picked before the latter need all the space. Thus lettuce or radish goes between cabbage or staked tomatoes. Succession cropping means the planting of one short-season crop after another, as beans following spinach. It is, on the whole, not wise to put other plants in the same rows with tall-growing plants, such as pole beans or corn, but rows of short-season plants may go between. Squashes and corn, however practical they may be when raised in combination on the farm, do not yield their best when combined in the garden.

This planning should all be carried out to the last detail, so as to keep the garden working at all times. The spacing depends, of course, on whether horse or hand culture is to be used; but in either case the rows should not be too near together for the plants' sake, nor too far apart for the worker's. A list of distances is given below. When finally the plan, probably after several changes, has been finished, it should be carefully inked, or marked clearly with a lead pencil that will not rub.

If the garden is an old one the last-year plan will of course be of use in planning, for even in so small an area as a vegetable garden rotation can be practiced. In this two things may be remembered: first, a crop should not always follow itself, as beans following beans, or tomatoes following tomatoes; second, it is well to keep the leguminous crops together, and to follow them by non-leguminous crops in the next year. The following crop then gets the advantage of the nitrogen left by the legumes.

The plan herewith reproduced is for a fairly large family, and is made according to general tastes. To suit family preferences the gardener will vary the quantities planted. (In my garden, for example, I never plant parsnips or turnips, but I make up for this with marrows, cauliflower and okra.) The distances given on the plan are for hand cultivation, for which some of the rows could be closer. Yet as cultivating in narrow spaces

Vary this prescription according to the taste of the family



Plantings are according to an average season, beginning about April 10. If the year is backward plant late. Do not hurry planting of whole season crops

Plantings are

1st.	April 10?	Round Peas, Wrinkled Peas Beets, Spinach, Turnips
2nd	3 days	Radish, Mustard, Cress, Peas, Kohlrabi, Onion Sets, Chard, Lettuce.
3rd.	6 days	Beets, Parsnip, Chard, Salsify Onion Sets, Early Cabbage, Peas.
4th	9 days	Turnip, Spinach, Peas, Cauliflower, Summer Cabbage, Lettuce, Onion Sets.
5th.	12 days	Risk a planting of Corn and Bush Beans. Beets
6th.	15 days	Mid-season Peas.
7th.	18 days	Tall Peas, New Zealand Spinach
8th	21 days	Last Peas. Set out Cauliflower Cabbage, Lettuce, Onion Sets, 1st. Celery. Sow Corn, Green Beans.
9th	25 days	Sow Winter Celery Seed
10th.	30 days	Corn, Wax Beans
11th.	35 days	Corn, Shell Beans, Cucumbers, Summer Squash, Marrow, Bush Limas Pole Kidney Beans, Eggplant, Tomato, Potato, Melons, Pepper.
12th	40 days	Pole Limas. Summer and Winter Radish. Set out: Cucumbers, all Squashes, Melons, Tomatoes, Pepper
13th.	45 days	Corn, 2nd Cucumbers and Marrow, Summer Squash.
14th.	50 days	Corn
15th.	55 days	Last Corn, Cucumbers, Marrows, Summer Squash. Set Winter Cabbage, Celery and Cauliflower. Sow Last Beets and Turnips.

PLAN FOR VEGETABLE GARDEN 165 × 100 FEET
THE SAME GENERAL IDEA MAY BE ADAPTED TO A GARDEN OF ANY SIZE

between seedlings is very delicate work, the 2-foot limit should be maintained if so much space can be afforded. It will be observed that the tall plants (corn and pole beans) are together, to prevent shading smaller plants. The legumes are in a solid block. Companion and succession cropping are planned for as much as seems wise in a home garden; much cover cropping, which means enriching, can be done. The potato patch may be added or not, according to farm or garden conditions. On the margin of the plan a table of approximate planting dates is given.

The beginning of this season of planting varies in Massachusetts from early until late April, according to four conditions. Toward the south, or near the sea, the season is much earlier than near the Vermont hills. The nature of the soil, its texture and drainage, next influences earliness, but is the one factor which can be changed. Exposure (easterliness or westerliness, and the valuable protection given by a windbreak) may make a difference of several days. Finally, the season itself varies considerably from year to year. Distrust an early spring; it may be treacherous. Correspondingly, a backward spring may be kindly. Never be in a hurry to plant the whole-season crops, such as parsnip or late cabbage. With them a few days counts for little.

In studying the garden plan the reader may find names of plants which he has never grown. Yet none of them are merely "fancy." Chard and New Zealand spinach are very dependable summer greens, yet on many of our farms and gardens they are still unknown. Thin chard to 18 inches; plant the spinach in hills 4 or 5 feet apart; both plants may be picked all summer. Kohlrabi is an above-ground turnip; it should be picked young. No garden should grow pumpkins when it can grow squash, except for jack-o'-lanterns. Vegetable marrow is a summer squash which bears very freely and can be cooked in several ways. The small marrows are excellent for canning. As for carrots, no one knows how good they taste until he tries the small forcing varieties. Okra is for gumbo soup. Savoys are more delicate than common cabbage. Endive (do not get the root-crop kind) is a fall lettuce, which to be at its best should be blanched by tying up the heads. Sugar peas, to be treated like string beans, add much to table variety. And finally, every garden should have a few hills of muskmelons and watermelons as delicacies. There is no fear of their crossing with squash or cucumber.

These newer kinds of vegetables add to the interest of the garden, first by giving variety to the table, and next by keeping the gardener awake to the work that plant-breeders are doing for his benefit. The progressive gardener will grow at least one new plant, or a new variety of a well-known plant, every year.

The list of vegetable varieties given at the end of this article is intended as a partial guide for buying. Unfortunately, after a few years such a guide becomes antiquated. But when new it names standard varieties which can be bought of most New England seedsmen. Further, it shows at all times the various classes into which can be divided such plants as beans, corn and radish.

Having finished the plan and decided what varieties shall be used, the next important piece of work is ordering the seeds. Generally speaking, it is safe to calculate from the data given in most seedsmen's catalogues, and from the space to be covered in the garden, the amounts of seed necessary. For example, the catalogue will state that a quart of bush beans will sow 100 feet of drill; and that of pole beans, a quart of limas will plant 100 hills, and of smaller sorts, 200 hills. Knowing how many feet and hills we wish to plant, the quantity to order is readily calculated.

But where shall the seeds be bought? Unless previous testing has proved the local grocer to carry reliable seeds he is usually the last one to depend on. To be sure, his seeds come in an attractive show-case, and in envelopes with gaudy pictures; but on the average these seeds had better be avoided. Buy preferably of a man who makes seed-handling a large part of his business, and whose living, therefore, depends on the excellence of his stock. If there is no such man at hand there are several such in each city who publish excellent catalogues and who can safely be dealt with by parcel post. Your farm journal will name for you some of these men. They usually pay postage on all seeds except the bulky packages of beans, peas and corn. It is insurance to deal with such men.

Seed-catalogues are usually published in January. It is well to order as early as possible, to insure prompt service, and also to make sure that a shortage of stock, which occurs almost yearly in some kind of seed, will not cause disappointment.

Early ordering also gives time for testing any seed of which for any reason the buyer is suspicious. If proved to be of poor vitality it can be replaced.

In the winter all necessary tools should be bought. The beginner at hand culture needs at least a spading fork (be sure to get one with a strap ferule), a hoe and a rake; line, stakes and labels; a trowel; and if not a wheelbarrow, at least a basket. He should have a wheel hoe if he can afford it. If his ground is free from stones, and his garden large, a planting machine will probably pay for itself. For horse culture, besides these tools the gardener will need a cultivator and possibly a seed drill. If he does not wish to buy the plow and harrow he can hire them once a year.

Fertilizer should also be ordered in the winter. When planted in large fields, vegetables properly require a different mixture for each crop; but in the vegetable garden this is not practicable. They are therefore best divided into two classes: those which are used for their stems or leaves, as spinach, chard, lettuce, cabbage; and those which are grown for their seed or root, as beans and peas, potatoes, turnip. The first of these should uniformly be treated with a nitrogenous fertilizer, say a reliable *high-grade* top-dressing; the second should be given a similarly good potato fertilizer. The reason for this difference is of course simply because nitrogen, when given in large proportion, stimulates to top growth instead of to blossom or root growth. But nitrogen, in the form of nitrate of soda or sulphate of ammonia, should always be on hand to give in very small quantities, to struggling young seedlings, or to plants when just set out. It should be given as a top-dressing and washed in with water (manure-water is just as good); the other fertilizers may be given in the same way, or sowed beneath the plants in the drill or hill, to give a good start.

No one will garden for many years in succession without some attempt to lengthen his season by the aid of glass. If the tomato and lettuce plants are started in the south window in boxes, some weeks may be gained in their growth. Flats may be easily made of old tobacco or starch or soap boxes, cutting them down to an inside depth of about 2½ inches. With good medium loam, with care not to water either too little or too much, and with either thinning or transplanting when the plants have four true leaves, good plants may be raised. Cabbage, cauliflower, squash, eggplant and still other plants may thus be raised in considerable numbers in very small space. Cucumber, squash, marrows and melons should be raised in individual holders, such as strawberry baskets, as they transplant poorly.

Equally simple is the aid which can be given to plants in the open garden, to protect from the cold. Small boxes, having neither bottom nor top, can be set over single plants; with a pane of glass to each, removed when the sun is very hot, the boxes become tiny cold-frames. In default of glass, or with boxes too large for the use of single panes, cheesecloth may be used; or this may be tacked over a melon crate or peach basket. This latter kind of protection, which need never be removed until the plants are crowded, is particularly valuable over hills of cucumber or squash or melon, as it keeps away insect pests. Similarly, cabbage or cauliflower plants raised in a small frame over which cheesecloth is tacked cannot be attacked by the maggot until they are ready to transplant.

The step beyond such home-made devices is the attainment of a cold-frame. One may be made to fit such old sash as may be at hand; or it may be bought for the standard 3 by 6 foot sash. These sashes, with overlapping panes to shed water, may be bought in all quantities; but it will pay to have them of cypress, strongly put together. Double-glassed sashes are becoming popular. A four-sash frame, partitioned into two sections, for hardy and for tender plants, will provide early plants for a garden of considerable size, and ought to be enough for a large family.

The management of a cold-frame is very simple. The seed is sown in rows 3 to 6 inches apart, and the plants are thinned, watered and transplanted until large enough to set out in the garden. Care must be given to ventilation in frosty weather, both to keep the plants from burning in the sun and to keep them from freezing at night. Mats and shutters are needed to keep out heavy frosts.

A hotbed is only a cold-frame, under which hot manure is placed to keep the ground warm. It needs extra care, first to bring the heating manure to the right temperature, and next to keep the seedlings from damping off in too moist an atmosphere. In Massachusetts the hotbed may be started late in February, the cold-frame a month later.

As spring approaches, work in the open garden begins. Nothing can be done until the frost is out of the ground, but even then the soil, unless light and well drained, may be too wet to handle for several days more. Then the plowed ground may be smoothed by the harrow or by the hoe and rake; or in case the garden is to be manured the dressing may be disked or spaded in. In hand work it is well to get out all stones larger than a hen's egg, — tedious work in ground where more work up each year, yet in the long run sure to pay, — and also all roots of such perennials as witch grass. When the surface is smooth, planting may begin.

In planting the nature of the different plants must be accommodated to the stages of the season. Certain plants are hardy to light frosts: such are beets, cabbage, Brussels sprouts, cauliflower, celery, carrot, chard, cress, endive, kale, kohlrabi, leek, lettuce, parsley, parsnip, pea, radish, salsify, spinach, turnip. Other plants are easily injured or killed by frost: such are beans, corn, cucumber, eggplant, muskmelon, okra, pepper, squash, tomato, watermelon. So long as frosts are likely, therefore, say until the middle of May, it is safe to sow only hardy plants. Yet it is often safe to risk an early planting or two of corn and beans. As the danger of frosts lessens, the tender plants may be sowed. Since potatoes are tender, they should seldom be set out before the middle of May.

Planting distances should be such, both in and between the rows, that the plants will not crowd. Crowding means stunting, and stunted plants cannot yield a proper crop. As already noticed, for convenience in cultivating a garden of any size, where the work must be done rapidly, and usually with a wheel hoe, it is not wise to have the rows much less than 2 feet apart. Nevertheless, where space is limited, and where the gardener is prepared to work delicately, rows of small plants such as radish, forcing carrot, cress and lettuce may be as close as 9 inches; and larger plants such as salsify, carrot, bush beans and peas may be 18 or 20 inches apart. In such a garden rows of dwarf corn may stand 2 feet apart, with single plants a foot apart in the row; pole beans may be in hills 30 inches apart each way; and cucumber need be scarcely wider spaced. Nevertheless, since on the farm there is seldom need of such intensive cultivation, the following spacing will be more convenient to follow.

The spaces are for hand culture. For horse cultivation the narrowest alleys should be widened to at least 30 inches. Where rows of a larger and a smaller plant stand side by side give the larger space or "split the difference." (In the table, ′ stands for feet and ″ for inches.)

Asparagus, 4′ x 18″.
Beans: —
  Bush, 2′ x 1′.
  Pole, 4′ x 4′.
Beet, 2′ x 4″.
Brussels sprouts: —
  Dwarf, 2′ x 1′.
  Standard, 2′ x 2′.
Cabbage: —
  Early, 2′ x 2′.
  Late, 3′ x 2′.
Carrot: —
  Early, 2′ x 9″.
  Late, 2′ x 15″.
Cauliflower: —
  Early, 2′ x 2′.
  Late, 3′ x 2′.
Celery: —
  For blanching with boards, 2′ x 9″.
  For earthing, 4′ x 9″ (or set in double rows 1′ apart, the plants 9″ or more apart in the rows, in alternate spaces; 4′ between the double rows).
Chard, 2′ x 18″.
Corn: —
  Early: hills 30″ x 30″ (or rows 30″ apart, plants 1′ apart).
  Later: hills 4′ x 4″.
Cress, rows 2′. Do not thin.
Cucumber, 4′ x 4′.
Eggplant, 4′ x 4′.
Endive, 2′ x 1′.
Kale: —
  Dwarf, 2′ x 1′.
  Standard, 2′ x 18″.
Kohlrabi, 2′ x 9″.
Lettuce, 2′ x 9″–12″.
Muskmelon, 4′ x 4′ or more.
Mustard, 2′. Do not thin.
Okra, 2′ x 18″.
Onion, 2′ x 6″–9″.
Parsley, 2′ x 18″.
Parsnip, 2′ x 18″.
Peas: —
  Bush, 2′ x 2″.
  Tall, 3′ x 2″.
  (Plant peas in rows 6″–9″ apart; dwarf peas support each other; for tall peas, put the wire between.)

Pepper, 2′ x 2′.
Potato, 2′ x 14″.
Radish: —
  Spring and fall kinds, 2′ x 3″.
  Summer, 2′ x 1′.
  Winter, 2′ x 2′.
Rhubarb, at least 4′ x 4′.
Salsify, 2′ x 12″–15″.
Spinach, 2′ x 9″–12″.
  New Zealand, hills 4′ x 4′.
Squash: —
  Summer, 4′ x 4′.
  Vegetable Marrow, 4′ x 4′.
  Winter, 5′ x 5′.
Tomato: —
  Staked, 2′ x 18″ (to be pruned).
  On frames, 2′ x 2′.
  Sprawling, 3′ x 2′.
Turnip, 2′ x 9″–12″.
Watermelon, 5′ x 5′.

The depth of planting varies somewhat with circumstances. The rule for planting in flats is to cover a seed to twice its thickness; but outdoors this can scarcely be followed, first because such delicate work is impossible, and second because soils vary. In a light soil, where there is danger of the seed's drying out, the planting may be twice as deep as in a moist soil. Small seeds in dry soil should be at least a quarter inch deep, but celery seed, which should always be planted in a seedbed, should be merely pressed into the moist earth; and, on the other hand, peas should go quite deep. It is well to plant peas in shallow trenches of about 6 inches depth, to cover lightly, and when the plants are growing to fill in the trenches in cultivating. This will insure deep rooting and plenty of moisture. After planting any seed, and firming the earth over it, scatter a light mulch of earth over the place, to prevent drying or baking.

After planting there is necessarily a time of waiting for the seedlings to appear. If weeds sprout, or if a rain comes and packs the surface, so that it bakes or dries out in the sun, the gardener will be anxious to cultivate. This will be dangerous unless the rows have been properly marked, and even then the work is delicate. But just as soon as the seedlings appear the work of cultivation should begin, and should be repeated as soon as weeds are numerous, and after every shower; for cultivation not merely kills the weeds, — it saves the moisture in the garden by coating the soil with an inch or two of dust, through which the water cannot evaporate. Properly cultivated, a garden will need little watering, even in a drought. But cultivation should be thorough.

Most modern gardeners are abandoning the hilling of corn and potatoes. Hilling injures the plants by cutting off the upper feeding roots. It also makes in the garden a greater surface for evaporation.

Thinning should begin early, as soon as the seedlings have four true leaves, and before they crowd, except as noted below. And as it is important that the plants should not injure each other, the gardener should have no mercy on the extra plants. But there are exceptions. Mustard and cress should not be thinned at all. Chard and beets and spinach, after first thinning to an inch or two, may be left to grow larger and to be thinned again from time to time, the thinnings to be eaten as greens.

The work of transplanting is made safe by a little care. Choose, if possible, a cloudy day, or work in the afternoon. Water the plants thoroughly half an hour before lifting. The ground to receive the plants should be moist. Dig the hole for each plant a little too deep, scatter in the bottom compost or well-rotted manure, with a little fertilizer, and cover lightly with earth; then fill the holes once with water. Lift the plants singly, with much earth, if that is possible, and set immediately; at any rate, keep them from the sun when once they are dug, and prevent the roots from drying out. Cut off half the leaf-surface, to equalize the loss of roots. Water the plants; and if the sun is hot, shade them, also, for the rest of the day and the hottest part of the next. Old strawberry boxes are excellent for shading small plants.

The work of gardening naturally changes with the season. As the summer advances, and the plants spread, the work of cultivating gradually lessens and that of picking begins. Here the average gardener makes the mistake of letting the crop grow too old. Beans grow stringy, peas tough, summer squash coarse. Nothing is gained by this, for plants from which the fruit is taken early make up by yielding more. It is much wiser to take the crop when it is young and tender. Okra and kohlrabi are ruined if not picked when young.

It is here that the proper management of a garden comes in. To know at just what stage each crop is, and to pick it when at its best, requires a little forethought. But garden management goes further than this. Staked tomatoes should weekly be pruned (one to three stalks) and tied. The watching of the crops leads to proper succession planting. The moment a row of plants has finished its usefulness it should be dug up, and no time should be lost in planting its successor. Thus early spinach is followed by cauliflower from the frames, or peas are succeeded by beets. As the summer advances it will be too late to follow with vegetables; but the cover crops should go in as promptly as possible, to get a good growth before winter. Garden management includes, further, a careful lookout for the coming of insect pests. Otherwise the squash bug or the cabbage maggot will do irreparable damage.

As soon as there is a sign of them, therefore, the campaign against them should begin. There is no space here to tell what to do in each case, nor how to take preventive measures against diseases. (Diseases can never be cured; the only salvation is prevention.) The reader should, for help in such cases, consult Circular No. 2, Massachusetts State Board of Agriculture, "Insecticides, Fungicides and Directions for their Use."

Neatness in the garden is worth while not only for itself, but for its results. All rubbish should be gathered daily, and piled in some out of the way place. The resulting heap is called the compost heap, and if the garden waste is not given to the pigs or chickens, it yet can do good service by turning itself into the best of earth mold, valuable in providing earth for the flats, or for enriching the hills of squash and melons. Compost is quite as valuable as manure.

The saving of seed is often possible in the garden. If the gardener is sure that there has been no crossing, and likes his strain of corn or squash or tomato, he cannot merely save himself a little money, but can by careful selection even improve his seed.

From late summer onward the garden would begin to look bare were it not for cover crops. These, as already mentioned, should be sowed in every space as soon as it is vacant. In summer crimson clover is the best to use; as frosts approach, winter vetch will be better; and after frosts begin rye is best used for a quick result. When turned under, these will provide plant food.

The coming of frosts challenges the gardener to protect his plants. The tall plants, such as corn, must meet their fate; but the low-growing can often be saved by the use of old cloths, burlaps or bedding hay. Tomatoes (staked tomatoes may be laid down), squash and cucumbers can thus often be saved for weeks. But at last even the cabbages must be taken up, if they are to be saved, or if they are in the way of the final preparation of the garden for the winter.

This should consist, if the gardener can possibly afford it, of the plowing under of manure. Cover crops, if large, may be plowed under also; or else, if they are small, or if the slope of the garden renders it liable to winter washing, they may be left for surface protection until spring.

Roughly, then, this reviews the work of vegetable gardening. The city man regards it as a desirable pastime; but the average farmer is still but too likely to resent it as an encroachment upon his time. He fails to realize the money value of his crop; fails also to perceive the aid to health which he and his family gain from food which not even the richest magnate can improve upon.

List of Vegetable Varieties.

Asparagus: Argenteuil, Palmetto, Reading Grant (if buying roots, get only one-year).

Beans (Bush): —

- Snap (Green): Stringless Green Pod, Valentine, Refugee.
- Snap (Wax): Kidney Wax, Golden Wax, Currie's Rust Proof.
- Shell: Horticultural, Green-seeded Flageolet.
- Lima: Burpee's Bush, Henderson's Bush, Fordhook Bush.

Beans (Pole): —

- Snap (Green): Kentucky Wonder.
- Snap (Wax): Golden Cluster.
- Shell: Golden Carmine, Scarlet Runner.
- Lima: Challenger, Carpinteria, Sieva.

Beet: Crosby's Egyptian, Edmands'.

Brussels Sprouts: Aigburth (Standard), Dwarf French.

Cabbage: —

- Early: Early Jersey Wakefield, Copenhagen, Early Vienna Savoy.
- Late: Danish Ballhead, Flat Dutch, Green Globe Savoy, Red Dutch, Red Rock.

Carrot: —
Early: Parisian forcing.
Medium: Chantenay.
Late: Danvers Half Long.
Cauliflower (get the best seed!): —
Early: Early Snowball, Early Erfurt.
Late: Autumn Giant.
Celery: Golden Self-Blanching, Boston Market, Giant Paschal.
Chard: Lucullus.
Corn: —
Early: Peep o' Day (white). Golden Bantam (yellow).
Medium: Crosby.
Late: Evergreen, Country Gentleman.
Cress: Curled, or Peppergrass.
Cucumber: White Spine, Russian (short).
Eggplant: Black Beauty, New York Improved.
Endive: Winter Curled, Escarolle (do not get the root plant, chicory).
Kale: Dwarf Green Curled, Winter (or German Greens).
Kohlrabi: White Vienna, Purple Vienna.
Lettuce: —
Heading: May King, Tennisball (black-seeded), Big Boston, Mammoth Black-seeded Butter.
Curled: Hanson, Simpson, Grand Rapids.
Cos or Romaine: Express, Trianon.
Muskmelon: —
Green or yellow flesh: Long Island Beauty, Rocky Ford.
Red Flesh: Emerald Gem, Fordhook, Honey-drop.
Mustard: White.
Okra: Dwarf Green.
Onion: —
Sets: White, Yellow and Red.
Seed: Yellow: Danvers, Ailsa Craig, Prizetaker.
Seed: White: Silver King, Portugal.
Seed: Red: Globe, Wethersfield.
Parsley: Moss Curled, Dobbie's Curled.
Parsnip: Early Round, Hollow Crown.
Peas (varieties given are wrinkled only): —
Early: American Wonder, Gradus, Sutton's Excelsior.
Medium: Alderman, Advancer, Dwarf Telephone.
Late: Telephone, Stratagem.
Sugar: Mammoth melting.
Pepper: Large Bell, Ruby King, Upright Sweet Salad.
Radish: —
Spring and fall: French Breakfast, Icicle.
Summer: Strasburg, Stuttgart.
Winter: Sakirajima, Spanish.

Rhubarb: Victoria, Linnæus (buy roots. Rhubarb does not come true from seed).

Salsify: Mammoth Sandwich Island.

Spinach: —

Long Standing, Round Thick Leaved, Prickly Seeded (for fall sowing).

New Zealand Spinach (to be cropped all summer).

Squash: —

Summer: Summer Crookneck, Mammoth White Bush (pattypan).

Vegetable Marrow: English, Italian (Cocozell).

Winter: Delicious, Hubbard.

Tomato: Dwarf Champion, Dwarf Stone, Livingstone's Stone, Stirling Castle (medium size), Ponderosa (very large).

Turnip: Snowball, Cowhorn (long white), Yellow Stone.

Watermelon: Halbert Honey, Early Fordhook, Cole's Early.

Potato: —

Early: Irish Cobbler, Early Rose.

Medium and late: Green Mountain, Beauty of Hebron.

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THE SANITARY SIDE OF FARM WATER SUPPLIES.

X. H. GOODNOUGH.

FROM THE SIXTY-SECOND ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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THE SANITARY SIDE OF FARM WATER SUPPLIES.

X. H. GOODNOUGH, CHIEF ENGINEER, STATE DEPARTMENT OF HEALTH.

The methods of obtaining water supplies for the farm in Massachusetts differ considerably from place to place, with the varying conditions of topography and soil. In the hilly regions in the central parts of the State, and in the mountains west of the Connecticut River, the farm water supply is obtained in many cases from springs located on a hillside at a higher level than the farm buildings, and the water is consequently supplied by gravity, giving running water in house and barn. In the sandy regions of Cape Cod and the southeastern parts of the State water supplies are commonly obtained from tubular wells driven in the porous soil. These wells are usually wrought-iron pipes having a diameter sometimes as small as 1 inch and sometimes as great as 8 inches, but usually a diameter of 2 or $2\frac{1}{2}$ inches is preferred. In some cases water is taken from brooks, ponds or running streams, but the number of such supplies is small.

By far the greater number of farm water supplies in Massachusetts outside the limits of town or village water works systems are obtained from ordinary wells dug in the ground and curbed commonly with field stone, the usual diameter being 3 to 4 feet. The number of wells and springs used for the water supplies of farms and village homes in Massachusetts is undoubtedly very large, notwithstanding the fact that 95 per cent of the inhabitants of the State live in cities and towns which are provided with public water supplies. In the cities and the larger towns the public supply is available to practically all of the inhabitants, but in the smaller towns only the villages and thickly settled areas are supplied by public works as yet, and there is consequently a considerable number of inhabitants in the cities and towns which are provided with public water supplies who must depend on their private sources.

The total population living in towns in which there is no general supply was, in 1912, about 170,000. There are probably 50,000 people having private water supplies who live in towns in which a portion of the inhabitants are supplied from public works. Allowing five persons to a family, there are probably more than 40,000 families in the State who maintain private water supplies, and, assuming that there is an average of one such source of supply to each family, there are 40,000 or more private water supplies in use on the farms and in the villages in Massachusetts.

Massachusetts has long been settled, and there has been comparatively little division of farms in many years. Undoubtedly a large percentage of the farm wells now in use were constructed many years ago, and have been in use continuously for a very long time, in some cases, no doubt, for much more than half a century. In earlier times little or nothing was thought of the danger of the pollution of the water supply from the wastes of human life except from possible pollution discharged directly into the well, and a well water that was clear, colorless and free from taste and odor was regarded as wholly satisfactory.

The well from which water was to be taken for household use was commonly located as close as practicable to the farm buildings, especially the dwelling house, for convenience in obtaining water for household use. The water was drawn commonly with a bucket and later with a pump, and at many of the farm and village dwellings the household well was for convenience located in the cellar of the house, or even in a corner of the barn. The household sewage is also commonly disposed of in the immediate neighborhood of the house, and at the older places the privy, cesspool and sink drain, and the barn with its manure pile, are often found located at no great distance from the well.

The question is often asked why old wells which have apparently yielded, and probably did yield, good water many years ago do not furnish water of the same quality to-day; and it is often difficult for dwellers in a village or on well-kept farms to understand why a well which has apparently yielded good water for many years does not supply good water to-day. The answer in many cases is that when the well was first dug the buildings which it was designed to supply had only just been constructed, and little or no sewage had ever been deposited upon the ground in the region about the well. As soon as the premises were occupied the seepage from the privy, sink drain and cesspool, which were commonly located at no great distance from the well, began percolating into the ground in its neighborhood. The drawing of water from a well naturally draws the ground water at that point to a lower level than elsewhere in the neighborhood, and induces a flow of water through the ground in its direction, and where sewage is discharged upon or into the ground in the region influenced by the draft of water from the well, seepage therefrom would naturally have a tendency to flow toward the well.

It is probable that in the beginning, and perhaps for many years, polluted matter from privies, cesspools, etc., thus percolating through the ground was thoroughly purified by oxidation and nitrification in its passage through the soil before reaching the well, just as the sewage of villages and towns is now purified by passing it slowly and intermittently through sand filter beds; but after a long period of continuous passage of water containing organic matter through the ground with air constantly excluded, the efficiency of the purification becomes less and the effect of the pollution upon the ground water more serious. It is also probable that the finer matters in the soil are gradually washed out, and the passage of the water through the ground thus allowed to become more rapid.

The indications are that polluting matter from a privy or cesspool percolating toward a well does not spread out over a very large section of soil, but where the soil is fairly homogeneous is confined to a section of about the same area as that of the privy or cesspool from which it comes. It is sometimes practicable to determine quite definitely the area affected by seepage from a privy or cesspool when excavations are made at a point where such receptacles for sewage have been located. An example of this was once seen by the writer, where a reservoir, upon one shore of which were located several privies and cesspools, was drawn down, exposing a steep slope from which the surface soil had been removed when the reservoir was built. In this case the indications of the areas through which the liquid percolating from the privies and cesspools to the reservoir was passing were very clearly marked by the iron rust which settled out of the water on its coming to the air at the bank of the reservoir, and the traces of percolation from these eight or ten receptacles were in each case very clearly marked. In these cases it was evident that the path of the polluted water was quite direct, and that the area of cross section through which it passed was but little greater in any of these cases than the area of the privy or cesspool itself. The path of the waste had evidently remained the same for many years, indicating that the passage of the polluted liquid did not have a tendency to clog up the ground, but that rather the ground offered less resistance to the passage of the polluted water as time went on. The soil in this case was but slighly porous, being what is sometimes called a gravelly hardpan.

The rate of percolation of water through the soil varies greatly with the character and porosity of the material, and liquid percolating from a cesspool toward a well may require a long time in its passage through the ground before it materially affects the character of the water of the well, but where the soil is porous sand or gravel, and much water is drawn from the well, percolation may be rapid.

Under the general geological conditions in Massachusetts, the water which enters a well is derived from the rainfall which falls upon the ground immediately about it and percolates through the ground to the well. The area from which ground water is influenced to flow toward a well depends upon the porosity of the soil, the quantity of water drawn, and the general trend of the ground water of the locality in which the well is situated. The area from which a well derives its supply cannot always be determined very definitely, but it can usually be determined with sufficient accuracy for practical purposes.

An average family of six persons would ordinarily use — with the water required for animals, etc., and allowing a small amount for irrigation of gardens about the house in the summer season — about 600 gallons per day. Assuming an average rainfall of 42 inches per year, about 8,500 square feet of land would be required to collect from the average rainfall the quantity of water used by the family. This would mean a circular space of ground 104 feet in diameter; but, inasmuch as a large part of the rainfall runs off of the ground as it falls, the amount that a well is capable of yielding practically never equals the amount of the rainfall.

An average of one-third of the rainfall on the drainage area of a well is a very large yield, and the quantity is usually much less. Assuming that one-fifth of the rainfall is collectible in a well, the area of ground required for securing a supply of 600 gallons daily would be a space 230 feet in diameter; that is, a privy or cesspool located within 115 feet of a well which derives its water equally from all directions would be likely to drain toward it, even if the rainfall were distributed in equal daily quantities throughout the year.

Of course, the yield of rainfall varies, the amount being large in the winter and spring and small in the summer and autumn, so that in the drier portion of the year water would probably be influenced to flow toward the well from a considerably greater distance than 115 feet.

The foregoing figures refer only to average conditions where the soil is of the same porosity and character over a considerable area. As the character of the soil usually varies considerably, even in short distances, the flow of ground water is probably not usually the same from all directions about a well. There is also likely to be a variation in the flow of water toward a well due to the slope of the ground water, so that pollutions discharged into the ground may be carried to the well from a much greater distance on the side of the well from which the ground water flows most freely than pollutions deposited in other directions about the well.

The surest way of securing a supply of water that is safe for drinking from a well dug near a farmhouse is to so locate the well and the places of disposal for sewage, viz., sink drain, cesspool, privy, barn, etc., that drainage from any of these will not affect the well. The best plan is, of course, to locate the sink drain, cesspool, privy and barn at a lower level than the well, but obviously this can be done only in comparatively few cases where it is desired to locate the well in the immediate neighborhood of the house. Where it is impracticable to dispose of the household sewage at a lower level than the water in the well it is important to locate the places of sewage disposal as far as practicable from the source of water supply. If the soil is sand or gravel and fairly homogeneous a distance of 250 feet will probably be adequate, provided, of course, that the sewage disposal receptacles are not placed in a locality from which the ground water drains most readily toward the well.

It is usually not very difficult to determine the probable trend of the ground water and to take advantage of it in locating the well in such a way that, under the conditions mentioned, drainage from the sewage disposal places is unlikely to affect it.

Where the buildings are located on sloping ground, draining toward a stream or pond, and the well is on the upper side of the buildings and the sewage receptacles on the lower side, the latter may be located at a lesser distance from the well without affecting the quality of the water than where the ground is more nearly level; but it is not advisable, unless expert examination shall show otherwise, to locate a receptacle for sewage nearer than 250 feet from a well unless, of course, the sewage is discharged at a lower level than the water in the well.

It sometimes happens that in order to dispose of the sewage effectively and satisfactorily it is necessary to convey it in a pipe for a considerable distance, and the pipe line may perhaps have to pass near the well or through the soil draining toward the well. In such cases it is always best to construct the pipe of iron with tight lead joints throughout the section likely to be affected by drawing water from the well. In order to make sure that the pipe is tight it should be carefully laid, the joints made tight and tested by filling the pipe with water under considerable pressure before the trench is filled in.

Covering of a Well.

While the most important requirement in maintaining a good well water supply on a farm is to so dispose of the sewage that it will not affect the water, it is also important that the well be carefully covered so as to prevent the entrance of surface water and prevent animals or objectionable matter from falling into it.

The best protection — and usually sufficient — for a well is to lay the upper 5 feet of the stone curbing in cement mortar, carrying the curbing to a few inches above the level of the ground, so that surface water will be diverted from the well and cannot enter it at the top. A cover should be placed over the well or upon sills of joist set in cement on top of the curb. A small box or pipe rising above the platform and with an opening in its sides will provide sufficient ventilation, but it is important that the opening should be screened with fine wire.

If water is drawn from the well by a pump passing up through the platform it is highly important that the platform be made absolutely tight and so sloped that water falling upon it will be carried away from the well. One of the most serious dangers of pollution of a well is water washing from dirty boots upon the platform.

Effect of Lead Pipe.

If the water is drawn through a pump and a suction pipe placed in the well it is best to avoid the use of lead pipe, since many ground waters act rapidly upon lead and cause lead poisoning. A pipe of block tin or of lead lined with tin, provided the pipe is made wholly of tin or of some suitable material where it is in contact with the water in the well, will be safe for use. Pipes of iron lined with tin, or especially with cement, are also satisfactory for conveying drinking water. Galvanized iron pipes are usually satisfactory, but waters which attack lead usually attack iron and, by taking up an excess of iron, make the water objectionable for many domestic purposes.

One other matter should be mentioned, and that is the importance of avoiding the heavy manuring of land in the immediate neighborhood of a well. This practice has been known to affect the water of many wells otherwise good, and it should be carefully avoided for a space of 100 feet or more from the well, especially on the side from which it derives its supply.

It is not practicable within the limits of this paper to go into the question of well-water analysis except in the most general way. Ordinarily, it is impossible to tell from the appearance, taste and odor of a well water whether it is safe for drinking or not. A clarified sewage in an ordinary glass may be clear and colorless and may have no very marked odor and is often not to be distinguished from spring water. The senses are wholly unreliable when it comes to deciding whether a water of good appearance and free from taste and odor is safe for drinking or not. On the other hand, if a well water which has usually been satisfactory becomes suddenly objectionable to taste and smell its use should be discontinued until an examination has been made.

Unpolluted waters are not usually affected by objectionable tastes and odors, though even to this rule there are exceptions, since quite often waters derived from hardpan soils have at times a noticeable taste and odor, even though analysis shows that the water is not polluted or otherwise objectionable for domestic use.

The sudden appearance of turbidity or color in a water which has always apparently been clear and colorless is also good cause for suspicion of the quality of the water even though it is free from taste and odor, and a water which becomes suddenly turbid or colored should not be used until its safety has been ascertained.

If the well is so located that there is no danger of pollution from sewage or other objectionable matter, slight changes in the quality of the water need cause no serious alarm. There are undoubtedly a great many cases in this State where a farm well is not located in such a way that its water can be used with safety for drinking, and in such cases a new supply is a necessity.

As to the best method of obtaining a new supply, it is impracticable to lay down any definite rules, since circumstances vary so widely from place to place that a rule by which a good well might be secured in one place would not produce satisfactory results in the next.

In the sandy and gravelly regions — found mostly in the southeastern parts of the State, but to a considerable extent in the river valleys of the central and western portions — it is usually not difficult to secure ground water in large quantity by sinking a well in low ground at almost any point, provided it is sufficiently distant from possible sources of pollution; but wells sunk in the immediate neighborhood of swamps will ordinarily not supply good water, and it is generally best in swampy regions to locate the well on the upland 50 to 100 feet from the swamp, if practicable. The conditions in some cases are such, however, that waters can be taken from the edge of a swamp or even from beneath its surface and good water secured.

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SEWAGE DISPOSAL IN RURAL DISTRICTS.

EDWARD H. WILLIAMS.

FROM THE SIXTY-SECOND ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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SEWAGE DISPOSAL IN RURAL DISTRICTS.[1]

EDWARD H. WILLIAMS, ROCKLAND, MASSACHUSETTS.

The message I bring this afternoon, it seems to me, is perhaps the most important one of the day.

We have been talking of better farms and better farming, and of the enormous crops that are being raised and which we hope will increase prosperity and lessen the cost of living.

Now if we are to have good crops we must have good farmers, and to be a good farmer one must of necessity be a healthy farmer; and if rural life is to be what it ought to be we must first of all look out for the health of the people living in the rural districts.

It is customary nowadays to speak of units in life and in business, particularly in the manufacturing and heat and power lines. I think that if we divide life into units we should consider the health unit as unit number 1. We must have health if we are to succeed in life and do anything well.

Let us consider some of the most important things that influence our health. Probably no one thing is more important to our well-being than a bountiful supply of good water, both for drinking and general domestic purposes. While a few, comparatively speaking, of our farmers procure their water from a well-protected public water supply, by far the greater portion must obtain their supply from springs or wells, and I am sorry to say that these latter do not always yield pure water. Roughly speaking, there are between 30,000 and 40,000 wells in this State that are in daily use, and, ridiculous as it may seem, there are only about 5 to 10 per cent of them that are unpolluted. Examination and analysis show these things in a much different way from that in which we generally consider them.

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[1] Address delivered before the field meeting of the Massachusetts State grange at South Framingham, August 19, 1914.

I do not mean to say that these wells that are not yielding a supply of pure water are all in an extremely bad condition, for such is not a fact, but they are more or less contaminated, some severely and some only slightly, and any well that shows pollution to any extent must be closely watched and studied to find out the cause. There are a number of ways by which the water in a well or spring can be contaminated, and probably the most common way is by the well being so situated that it receives the wash from the surrounding slopes which runs over the surface and into the top of the well, particularly during and after heavy showers and in the springtime when the snow is melting. Another and very serious way in which pollution of the worst kind may reach the water in wells and springs is by a closely located cesspool or privy of poor construction constantly discharging their contents into the surrounding ground. After a time the ground becomes saturated, and the area saturated increases until it has spread out for great distances in many cases. In very porous subsoils, or perhaps along the surface of or through the fissures in underground ledges, it is hard to estimate how far sewage may travel, but certainly for hundreds of feet in some cases.

People sometimes ask why a well does not or should not continue to give a good pure supply of water when it always used to, and I would say that it is because of this saturation of the soil, which in some cases may take years before it reaches the water supply, and also because the contamination is not always perceptible to the eye, nose or mouth, and only an analysis can show whether or not a well is polluted and to what extent. You see the trouble lies largely in the fact that germs of disease are invisible, and you cannot tell by looking at water whether or not they are present. By all means have an analysis made of any water that you use for domestic purposes as soon as you detect any taste or odor to it.

One of the worst diseases that we have to contend with is typhoid fever, and while the State health authorities have made a wonderful reduction in the numbers of cases and deaths in this State, it is still far too common. Typhoid fever is frequently contracted by using water from a well or spring that is polluted by sewage. Now typhoid germs will not live in well water very long, but if you have an underground connection between the well and your cesspool or privy you can keep up a constant supply of able-bodied typhoid germs in your drinking water and contract the disease. You know there are people who are known as typhoid carriers, that is, people who may continue to expel the germs from their systems for years after having recovered from an attack of the disease, and one of these carriers might come to your house and leave the germs to do their deadly work. So you see we must dispose of the sewage in some way so that it cannot reach the water supply.

The purpose of this little talk of mine is to tell those of you who are interested how the sewage may be disposed of in a very satisfactory manner in a large number of cases, but not in all cases, for this plan has its limits.

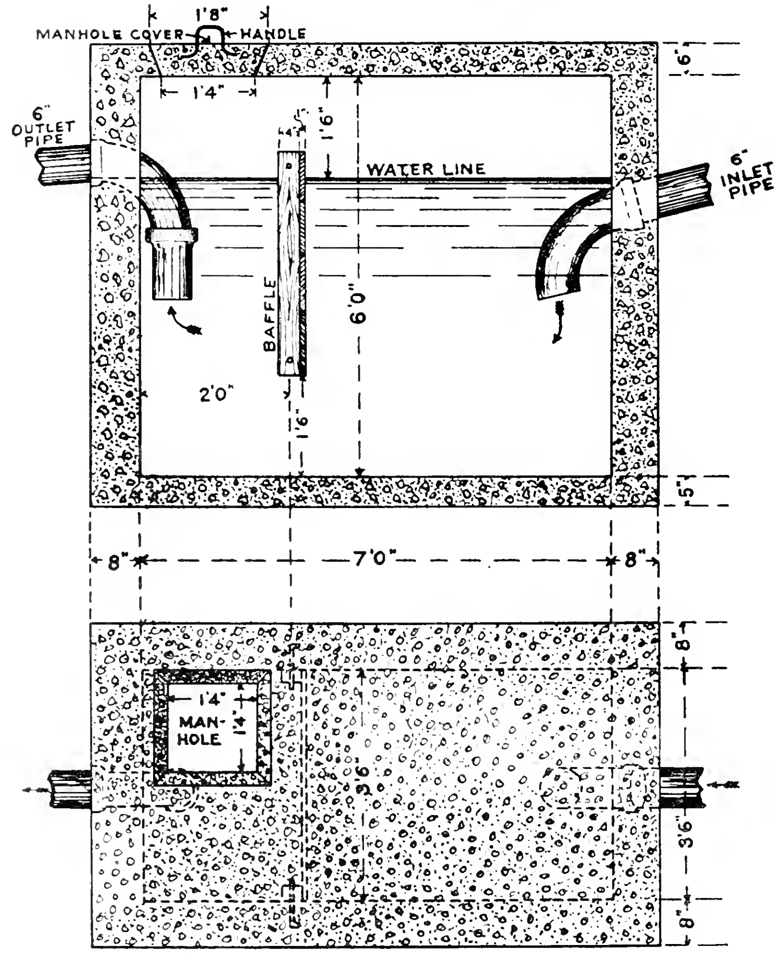
It is not designed for use in cities or towns where there is a sewerage system, or where the premises are so limited that you cannot construct the plant properly, or where there is danger of ridding yourselves of a nuisance only to pass it on to your neighbor. This system is what I call a farm sewage disposal tank, but it has several names, and is constructed as you see on the sketch. It is constructed of concrete and is made light and air-tight, as the successful working of the tank depends on the action of what are called anærobic bacteria, that work best when kept dark and quiet and with little oxygen. The bacteria do their work by consuming the solids, except the mineral matter, and converting them into water which is disposed of in one of the ways that we are to speak of.

The successful working of the tank also depends on a considerable quantity of water passing through it for flushing; and because it will handle a large quantity of water, it makes possible the installation of bathtubs, flush closets, laundry tubs and all of the modern plumbing conveniences that should be placed in every house in the rural districts just as they are in the city houses. These conveniences properly installed add so much to the health and convenience of rural life that their value is beyond estimation. Running water is necessary, of course, to operate the closets, baths, etc., and can be obtained in different ways. Where one has a supply of running water from a spring on a hill that is well protected from pollution he has what I consider an ideal supply. If you have not this kind of a supply you can have running water in your buildings by

Sewage Disposal Tank

FOR

Rural Residences



Scale ½" = 1'.

using a gasoline or hot-air engine, electric motor, windmill or a pneumatic tank to keep your supply tank filled.

The Sewage Tank.

The tank in the sketch is of sufficient size to take care of any ordinary farm home sewage, and is 7 feet long, $3\frac{1}{2}$ feet wide and 6 feet deep, these being inside dimensions; the side walls should be made 8 inches thick, the bottom 5 inches and the top 6 inches thick. If the tank is placed under a lawn or grassland where there is no heavy teaming over it, it will not need any reinforcing, but if placed beneath a driveway the top only should be reinforced. The manhole cover should be placed in one corner so as to enable you to remove the lumber you use for concrete forms without cutting it. The tank should be placed so that it is covered with at least 18 inches of soil, and then it will never freeze up. It must also be placed in such a way that the 6-inch inlet pipe has a good grade or slope to the tank, so that the water will have velocity enough to keep the pipe free at all times. You see the ends of the inlet and outlet pipes are submerged, which is done to exclude air and to prevent the breaking up of the scum on the surface of the contents of the tank, which acts as a sort of protective blanket for the bacteria.

The contents of the tank should be kept as quiet as possible, and as an aid in this matter we place a baffle board across the tank as shown. This baffle should rise a few inches above the surface line and have an open space 18 inches below it, to allow the heavy portion or sludge to spread over the whole bottom of the tank, where I believe it will be better taken care of by the bacterial action than it would in a smaller area.

Of course the 6-inch outlet pipe where it leaves the tank regulates the height of the material within, and is for the purpose of conducting the surplus water or effluent away to the place where it is finally disposed of. The outlet pipe should be set so as to allow an 18-inch air space above the flow or surface line.

Now as to the methods of disposing of the effluent. If you have to consider the protection of a water supply, as well as to dispose of the overflow, then you must conduct the effluent away to a point at least 200 feet from your own or a neighbor's water supply or any pond or stream connected with a supply.

Care must also be used so as not to dispose of the effluent in such a way that it can follow a ravine or depression in the ground surface that might convey it in a wrong direction. The best way of all would be to conduct it to a point under ground where there was a sand or gravel subsoil, and allow it to escape through a few open joints on the end of the outlet pipe, covering over the entire length of pipe.

In a properly constructed system there is so little sediment in the effluent that this underground outlet will dispose of it for an indefinite time in a porous material. Be sure and make tight joints in your pipes except at outlet end, and if you have to run either inlet or outlet pipes anywhere near a well it is advisable to use iron pipe at such a place and lead the joints.

I know of tanks that have been running now for several years, and have done the work so well that there is no amount of sludge in them at any time when opened. Members of the grange at several of the meetings have told their experience, and they expressed themselves as well satisfied, except in one instance, and that was when a double tank was used and the sludge accumulated in that one so as to block the inlet pipe. I think the tank must have been too small.

Now to return to the disposal of the effluent where you have no porous subsoil to take care of it. If you are located far from neighbors, and where you have a large area over which you can work without endangering any source of water supply, it would be all right to let the effluent run out onto the surface of the ground where it would get a good chance to spread out and not stand in pools, as of course mosquitoes would breed in the standing water.

Now there is another condition to consider, and that is where you have a limited area, and where you have to be careful about allowing the effluent, as it comes directly from the tank, to run out on the ground for fear of its going into some lake or stream that may carry it onto the land of another, and where it would be necessary to pass it through a sand filter before letting it pass off. A sand filter is easy to construct and adds greatly to the purity of the effluent.

Now a word in regard to waste water from the tank. Some people believe and some of the farm papers have stated that this water is good enough to drink; but it is not so, for you have not removed the bad matter entirely but have liquefied it and only made it possible to more easily dispose of the sewage.

The protection of the water supply by taking care of the sewage in this way would solve many vexatious problems.

How far-reaching the effect of using impure water may be can be illustrated by the thought of the awful possibilities of spreading a contagious disease by using this bad water to wash milk utensils, and as a means to cool milk by standing the cans in a tub of water in which there may be germs of typhoid fever. A farmer might be ever so particular about his cow barn, his cattle and himself and then use polluted water and thus his precautions be unavailing.

To illustrate the successful use of this system of sewage disposal I would like to tell you how, at Sugar Hill, New Hampshire, where the people depend upon money made by taking summer boarders, there were installed, at the suggestion of the New Hampshire State Board of Health, 30 or 40 of the tanks to eliminate a fly pest that was so severe that the summer people all went away. The help of the State Board was asked to remedy the difficulty, and an investigation showed that the flies were breeding and feeding in the open cesspools, privies and sink drains that were common at almost every place. After the sewage was taken care of by this method the flies disappeared and the summer people now go there as before. In their official reports they speak of the work and also published plans of a tank as designed by them.

The United States government and different States and colleges approve of this method of disposing of a serious menace to health in rural communities.

If you have conditions out of the ordinary by all means consult some one who understands the question thoroughly before spending your time and money.

The cost of the tank if constructed by your own labor should not be over \$16 or \$17; of course it is hard to say how much the piping would cost, as the lengths would vary for different cases.

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THE STARLING.

EDWARD HOWE FORBUSH.

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STARLING AT NESTING HOLE WITH CATERPILLARS FOR ITS YOUNG.

Starlings are useful birds if not too numerous. (Original photograph.)

THE STARLING.

EDWARD HOWE FORBUSH, STATE ORNITHOLOGIST.

The European starling (*Sturnus vulgaris*) was introduced into New York City in 1890, and now (1915) is distributed locally over most of Massachusetts. It is a native of western central Europe, winters south to Africa and is accidental in Greenland. It may be described briefly as follows: length, 8½ inches; adult male: black with purple and green reflections, the feathers of the upper parts and breast more or less tipped with pale buff, which gives the bird a spotted appearance when in hand, but at a little distance the spots are invisible; under tail-coverts edged with white; beak yellow; feet flesh-colored, tinged with brown; female: spotted below as well as above; young: uniform ash brown, faintly streaked with darker.

The starling may be recognized at a distance by its general appearance and manner of flight. It is about the size of the red-winged blackbird, but has a very short tail. It is dark or dusky in color, and during the breeding season its bill is bright yellow. Those who see it for the first time usually describe it as a blackbird with a yellow bill. In flight it flutters like a meadow lark, but seldom sails as much as does the lark.

The Starling in Europe.

In order to get some idea of what we may expect of the starling in this country we must first glance at its history in Europe. There it is one of the most abundant birds. In some sections it has been more numerous in the past than it is now, but on the other hand it is increasing in numbers now in many regions. Most of the starlings in northern European countries pass the winter in southern Europe, but reappear in the north very early in the spring, sometimes before the snow is gone; and in much of the northern part of its range a few individuals are resident throughout the winter. Although it resembles our blackbirds somewhat in appearance, it differs widely from them in its breeding habits. Like the house sparrow it is a close companion of man during the breeding season. In Europe it nests in hollow trees, in holes or crevices in rocks, walls, cliffs and buildings. It occupies suitable places about the eaves, and utilizes bird houses and nesting boxes, as does the house sparrow. It lays from four to seven greenish-blue eggs and in many cases raises two broods in a season. It is a very gregarious species, and even during the breeding season may be seen in small flocks, a few individuals or a family often consorting. By midsummer these small flocks begin to congregate into larger ones, containing hundreds of individuals, and increasing sometimes in the fall to thousands or tens of thousands. The largest flights are seen at the roosts. Usually the starlings from a large area concentrate on some marsh at night, where they roost in the reeds, and from these centers they scatter over the country to feed each day, returning every evening to the same roost, until the approaching winter, with its scarcity of food, compels them to wander about in search of it, or to resort to more southern regions.

The accounts of the vast numbers congregated at the roosts as related by European ornithologists seem almost incredible. Their numbers are set down as hundreds of thousands and sometimes as "millions," but such statements probably are somewhat exaggerated. It is certain, however, that these birds gather at the roosts in "clouds," such as sometimes are seen in the south, where our swallows concentrate in countless thousands at night over a marsh, and discharge their numbers into the reeds like a waterspout descending from a cloud. A somewhat similar manner of going to roost is attributed to the starling. Like our cowbird, it seems fond of frequenting pastures or places where cattle are kept. It is said to even alight on the backs of cattle and sheep in search of ticks and other insects that infest them. It is pre-eminently a ground feeder, and feeds on lawns, in grass fields and pastures, and also to some extent in gardens and plowed lands. It destroys grubs, earthworms, snails and many insects which infest grass lands and the droppings of cattle. It is conceded in Europe that the benefits it confers on the farmer far exceed the harm that it does by attacks on fruit or crops; nevertheless, there are many instances on record where the starling has become a pest to the farmer. The habit of collecting in enormous flocks is the great element of danger. When a great number of any species having grain-eating or fruit-eating propensities is collected in one locality they are capable of doing great harm in a very short time. Such flights, however, are often productive of good.

The forest authorities in Bavaria, during an invasion of the spruce moth or "nun" in 1889–91, noted great flights of starlings, which were credibly estimated to contain as many as ten thousand in a flock, all busy feeding on the caterpillars and pupæ of this moth. The attraction of starlings to such centers was so great that market gardeners seriously felt their absence in distant parts of the region.[1]

The injury that starlings are capable of doing in Europe may be judged from the following accounts. Mr. A. Butler Duncan of New York writes that he has known the starling to become a "perfect pest" in England. What the starling does to fruit in Great Britain is told in an extract from the "Agricultural Students' Gazette," quoted by Mr. S. H. Goodwin in "Bird-Lore," May–June, 1908, page 130.

> The starling is a splendid bird on grass land, foraging for leather jackets (larvæ of craneflies), wire worms, etc.; rids the sheep of a few of their ticks; but in a fruit district it comes in droves into the strawberries and attacks the cherries wholesale (Hereford); peas, apples, plums, as well as cherries (Kent), also raspberries. Very valuable insect destroyers, but getting too numerous (Notts). In my fruit field (between Marden and Colchester) I do not suffer very much from blackbirds and thrushes, nor do I grudge them their toll in return for their song. Only one bird is dangerous to my crops, — that is the starling. He threatened the utter destruction of our strawberry, raspberry, cherry, gooseberry and currant, and some other crops. These birds are said to come to us from the marshes as soon as the young are hatched. And they come in millions; in flocks that darken the sky. Their flight is like the roar of the sea, or like the trains going over the arches. Their number increased rapidly each year. I can look back to the time when there were few, and have watched their increase for forty years, till now it

[1] Fürst, Hermann: "Protection of Woodlands." English edition, translated by John Nisbet, 1893, p. 126.

is intolerable (Essex). The starling is a terror, and life around here is hardly worth living; you must have a gun always in your hand, or woe betide the cherries; they come in thousands (Sittingbourne, Kent).

Miss Gertrude Whiting of New York City writes me that in Switzerland enormous flocks of starlings come down like black clouds on the vineyards. In ten or fifteen minutes they pluck the fruit absolutely clean, and the cultivator is robbed of his year's crop. In the south of France starlings are said to be similarly destructive to the olive crop. This indicates what would happen in America were the starlings to become abnormally numerous.

It is of particular interest to learn what we can of the nature of the starling in its own country in its relations to other birds. In Europe the starling is known to eat the eggs and the newly hatched young of sparrows, but this habit does not seem to have been generally noted. Mr. Clinton G. Abbott, who is very familiar with the bird in Europe, writes me that he considers its pugnacious nature to be by far the most serious objection to the starling, and that no birds which nest in holes can have any peace at all until all the starlings are satisfied. "Many a time," he writes, "have I noticed the British woodpeckers laboriously boring holes in the hard wood, only to find that after a couple of weeks' work a pair of starlings had laid claim to the apartment." The woodpecker never gives up without a fight, but the starling is always victorious, and "the next day trailing straws from the entrance of the cavity show the presence of these new and slovenly tenants." It is said that starlings have become so numerous in parts of England that they evict other hole-nesting birds, and that it has become necessary to provide smaller birds with nesting boxes which the starling cannot enter. The pugnacity of the starling does not seem to be generally noted in the works of European ornithologists, but apparently at times starlings have battles among themselves. The following copy of an ancient tract, for which I am indebted to the kindness of Mr. Samuel N. Rhoads of Haddonfield, New Jersey, is both quaint and interesting: —

The Wonderful Battel of Starlings:

Fought at the City oj Cork, in Ireland, the 12th and 14th of October 1621. As it hath been credibly informed by divers noblemen and others of the said Kingdom, etc. London, Printed for N. B. 1622.

Cork is a City in the West of Ireland, in the Province of Munster; for Situation, and all Commodities, which Sea or Land may afford, not inferior to any City in that Country. About the 7th of October last, Anno 1621, there gathered together, by Degrees, an unusual Multitude of Birds called Stares, in some Countries known by the Name of Starlings. Quality bold and venturous, among themselves very loving, as may appear by their Flights, keeping together all Times of the Year, excepting the Breeding-Time. It is, and hath been an old Proverb, that Birds of a Feather hold and keep together; which hath even been a common Custom in these as much as in any other Kind whatsoever: But now the old Proverb is changed, and their Custom is altered clean contrary. For at this Time, as these Birds are in Taste bitter, so they met to fight together the bitterest and sharpest Battel among themselves, the like, for the Manner of their Flight, and for the Time the Battel did continue, never heard or seen at any Time, in any Country of the World. (I believe)

We read in the Histories of our own Country, that, in the twelfth Year of King Richard II. the Gnats mustered together at Shine now called Richmond, in great Abundance, with so great a Multitude, that the Air was obscured and darkned by them. They fought so violent a Battel among themselves, that, by Estimation, two Parts of them were slain, and fell to the Ground. The Number of those which were killed was so great that they were taken up with Shovels, and swept together with Besoms, that Bushels were filled with them, the third Part having gotten the Victory, flew away and vanished, no Man knew whither.

Now to come to the Fight of our Birds, the Stares or Starlings:

They mustered together, at this above-named City of Cork, some four or five Days before they fought their Battels, every Day more and more increasing their Armies with greater Supplies; some came as from the East, others from the West, and so accordingly they placed themselves, and as it were incamped Themselves Eastward and Westward about the City: During which Time their Noise and Tunes were strange on both Sides, to the great Admiration of the Citizens and the Inhabitants near adjoining, who had never seen, for Multitude, or ever heard, for loud Tunes which they uttered, the like before, Whereupon they more curiously observing the Courses and Passages they used, noted, that from those on the East, and from those on the West, sundry Flights, some twenty and thirty in a Company, would pass from the one Side to the other, as it should seem employed in Embassies; for they would fly and hover in the Air over the Adverse Party, with strange

Tunes and Noise, and so return back again to that Side from which as it seemed, they were sent.

And farther it was observed, that, during the Time they assembled, the Stares of the East sought their Meat Eastward, as the Stares of the West did the like Westward; no one flying in the circuits of the other.

These Courses and Customs continued with them until the 12th of October, which Day being Saturday, about Nine of the Clock in the Morning, being a very fair and a Sun-shine Day, upon a strange Sound and Noise, made as well on the one Side as the other, they forthwith, at one Instant, took Wing, and so mounting up into the Skies, encountered one another with such a terrible Shock, as the Sound amazed the whole City and the Beholders. Upon this sudden and fierce Encounter, there fell down in the City, and into the Rivers, Multitudes of Starlings or Stares, some with Wings broken, some with Legs and Necks broken, some with Eyes picked out, some their Bills thrust into the Breast and Sides of their Adversaries, on so strage a Manner, tht it were incredible, except it were confirmed by Letters of Credit, and by Eye-Witnesses with that Assurance which is without all Exception.

Upon the first Encounter they withdrew themselves backward, East and West, and with like Eagerness and Fury encountered several Times; upon which all these Stares fell down, in like strange and admirable Manner, as upon the first Encounter. They continued this admirable and most violent Battel till a little before Night, at which time they seemed to vanish, so that all Sunday, the 13th of October, none appeared about the City.

Upon this Sunday divers passengers came out of Suffolk, who sailing betwixt Gravesend and Woolwich, they heard a loud and strange noise and Sound in the Air, whereupon casting their Eyes upward, they saw infinite Multitudes of Stares fighting in all violent Manner together, with a Crow or Raven flying betwixt them, for the Flight being so high, they could not perfectly discern whether it was Crow or Raven. These Birds had also several Encounters, making strange Sound and Noise; and ever as they divided and retired themselves, the Crow or Raven was seen in the Midst: But what Slaughter was made they could not observe, because the Evening was somewhat dark, and the Battel was fought over Woods more remote off; but for more assured Proof of this Fight the Sunday before-named, there are, at this Time, in London, diverse Persons of Worth and very honest Reputation, whom the Printer of this Pamphlet can produce, to justify what they saw, at Cause shall require, upon their Oaths.

Now to return to the last Battel fought, at Cork, by these Stares

Upon Monday, the 14th of October, they made their Return again, and, at the same time, the Day being as ıair a Sun-shine Day as it was the Saturday before, they mounted into the Air, and encountered each other with like violent Assaults, as formerly they had done, and fell into the City upon the Houses, and into the River, wounded and slaughtered in like Manner as before is reported: But at this last Battel there was a Kite, a Raven and a Crow, all three found dead in the Streets rent, torn and mangled.

In this precedent Narration, one Report will cause most admiration, and that is, the Stares or Starlings, forbearing and absenting themselves from Cork, upon Sunday, being the 13th of October, should that same Day be seen to fight near, or not far off from Woolwich; whether the same Stares it may be held in respect of the Distance of the Place by Sea and Land, improbable. But this Improbability is soon answered; for as the Fight at Cork may seem strange and improbable, yet being most assured that such a Battel was fought, it may be as probable, in the Wonderful Works of Almighty God, that, notwithstanding the Distance of the Place, these may be the same Stares.[1]

The above extracts indicate that the starling has some undesirable qualities; and as such qualities are often accentuated when a bird is introduced into a new country, we cannot view the introduction of the starling without some apprehension. The fact that it is generally considered a desirable species in northern Europe should not have convinced any one that it would be so in America, and its introduction here ought never to have been undertaken. When introduced into New Zealand it became a very destructive pest, and no one can tell what may be the result of its acclimatization here. Since the successful introduction of the starling in America the Bureau of Biological Survey of the United States Department of Agriculture has been given authority to regulate the importation of foreign mammals and birds into this country, and in the future there is very little likelihood that the zeal of misguided persons who wish to import foreign species will have such results as followed the introduction of the house sparrow. The Biological Survey now has agents in every port where foreign species are likely to come in, all shipments are examined and if the bird or mammal is considered dangerous it is destroyed; thus we have been able to keep out the mongoose and several undesirable birds. But the starling, introduced before these regulations went into effect, has increased so fast and spread so far that the question now to be considered is whether it is to prove an undesirable addition to the fauna of the country, and, if so, whether its increase can be controlled and regulated.

[1] Morgan, J.: "Phœnix Britannicus," a miscellaneous collection of scarce and curious tracts, No. 1, pp. 250-253, London, 1731.

The Starling in America.

Its Introduction.

Probably we shall never know how many attempts have been made to introduce the starling into this country. I have learned of several. Mr. John Coulson of Worcester, Massachusetts, writes me that four starlings were caught from a small flock on the estate of Mr. Stephen Salisbury on November 8, 1876, and were kept in the house until November 11, when some one accidentally liberated them. Mr. Coulson, being a native of Great Britain, knew the birds well. Mr. William Conant of Tenafly, New Jersey, asserts that he had a tame starling there in a cage in 1884. At least six other starlings came about the cage of his pet bird, which he finally liberated and it disappeared. These starlings are believed to have reached Tenafly from Tuxedo, where several European species, including the English pheasants and partridges, were liberated at that time. Some of the pheasants and European partridges also reached Tenafly.

Mr. Van Brunt Bergen of Brooklyn, New York, wrote me in 1910 that Mrs. Doubleday liberated several pairs of starlings at Bay Ridge "eight or ten years ago." They came from England. But the introductions undertaken by Mr. Eugene Scheifflin at Central Park, New York City, are credited as the first to be successful. The first of his importations numbered 80 birds, which were liberated on March 6, 1890, and 40 more were released on April 25, 1891. Some of these birds remained in the park or in its vicinity, and bred there, but in 1891, 20 appeared on Staten Island, and in 1896 they had increased their numbers and had extended to Brooklyn. In 1898, according to Dr. T. S. Palmer of the Biological Survey, the species had obtained a strong foothold in the neighborhood of New York City; it had reached Stamford, Connecticut, and Plainfield, New Jersey. One hundred birds were liberated near Springfield, Massachusetts, in 1897, but Mr. Robert O. Morris of Springfield states his belief that they did not survive the following winter. It may be possible that they went south, but not one was reported from Springfield again until the year 1908. In the meantime the species had spread over the first forty miles of Long Island, up the Hudson River to Ossining and beyond, through much of eastern New Jersey and into Pennsylvania and Delaware.

In June, 1910, I was able, through the co-operation of the Bureau of Biological Survey, United States Department of Agriculture, to make an investigation of the distribution, food and habits of the starling in America. Several trips were made to Springfield, Massachusetts; Connecticut; Long Island; New Jersey, and one to Pennsylvania. A large correspondence was begun with people in all the States in which the starling has been found. One hundred and two starlings were collected, and the contents of their stomachs were examined by Professor F. E. L. Beal of the Biological Survey. On this investigation the present report is based.

It is important to compare what is known of the status and habits of the starling in this country with its history and habits in Europe, for by such a comparison we may be able to forecast its probable relation to other birds and to agriculture in Massachusetts.

Its Increase and Dissemination.

When the brief period that has elapsed since the introduction of the starling (twenty-five years) and the small number introduced are considered, it must be conceded that the increase and the dissemination of the species have been rapid. It has not increased or spread so rapidly as did the house sparrow (commonly called English sparrow), but the sparrow's numbers sprang not from one importation but from many, that took place at widely scattered localities during a series of years,—something that has been prevented in the case of the starling. Its increase has been rapid in most of the region now occupied by it, where it is in many places second in numbers only to the sparrow and the robin. The testimony of 110 correspondents whose residences are scattered over five States shows that the starling is increasing fast. All assert as a result of their observation that it is increasing, and most of them say that its accession is rapid. Only 18 have seen no increase in their localities or find the increase slow. They, however, are resident mainly near where the starling was first introduced, and where it has nearly reached the limit of food supply or nesting places. Even in Brooklyn, however, Dr. Edward W. Vietor, who keeps an excellent record of the birds observed at Prospect Park, records an average of 29 starlings daily in 1908, 31 in 1909 and 41 in 1910. Mr. J. H. Sage of Portland, Connecticut, states that two pairs were seen there in 1908, and that by June, 1910, the number had increased to about 100. During the breeding season the starling is rather quiet and secretive, and its numbers are not fully realized, but in the fall its large flocks become very conspicuous, and people are prone to exaggerate its numbers for the reason that these flocks roam over the country for miles, frequently appearing and disappearing, and giving the impression of great abundance. The most convincing proof of increase comes in the statements of people who saw the starlings in flocks of from 1,000 to 3,000 in the fall of 1909, and who found in the same localities in 1910 flocks estimated to contain from 8,000 to 10,000. In the region about New York City, including Long Island, Staten Island and parts of the Hudson River valley, also portions of New Jersey, where the sparrow is more abundant than I have ever seen it anywhere else in this country, there appeared to be at least 50 sparrows to every starling in June, 1910, but it is quite probable that now the ratio has been very materially changed in many places by the increase of the starling.

The spread of the starling since 1900 may be seen by the following statement.

In the year 1900 it appeared at Flushing, Long Island; East Orange, New Jersey; Chilmark, New York (Scarborough-on-Hudson); Norwalk, Stamford and New Haven, Connecticut. In 1901 the first birds are recorded from Delaware, taken near Odessa. In 1904 the starling had reached Rye, New York, and Trevose, Bucks County, Pennsylvania. In 1905 it is recorded from Newburg, New York; Elizabeth, New Jersey; and West Philadelphia, Pennsylvania. In 1906, Danbury, Wethersfield and Hartford, Connecticut; New Brunswick, Princeton, Red Bank and Vincentown, New Jersey, were included in its range. In 1907 it was seen in Stonington, Windsor, Bethel, Southington and New London, Connecticut; Upper Montclair, Morristown and Tuckerton, New Jersey; and Setauket, Syosset and Orient, Long Island. In 1908 it was seen in Millersville, Pennsylvania; Bedford Hills, New York; Portland and New Milford, Connecticut; and Springfield, Massachusetts. In 1909 it had reached Rhinebeck and Pleasantville, New York, and one was said to have been seen at Rochester. It was also met with at Milburn, New Jersey; Bristol, Pennsylvania; and Chester, Connecticut.

In 1910 Mr. Israel R. Sheldon of Providence told me that starlings had been breeding for "two or three years" at Silver Springs, Rhode Island, on the east shore of Narragansett Bay, about three miles below Providence. They must have reached this point in 1908 or 1909, if not earlier. He said that they nested in the peaks of the roofs of some cottages, behind some lattice work, and that he had seen as many as eight at one time. As the noise that they made disturbed the cottagers their nesting was repeatedly interfered with, which may account for the fact that they had not increased much. This is the only authentic occurrence of the starling in Rhode Island that had come to my notice at that time, but now (1916) the bird is more or less generally distributed in Connecticut, Rhode Island and Massachusetts, and has been reported from Maine, New Hampshire and Vermont, and from as far south as Virginia.

The increase and spread of the starling is due to its fecundity and its general fitness for the battle of life. It often has two broods in America, as it has in Europe. I am satisfied of this by my own observation and by the statements of other observers, and believe this to be the rule in some localities, although in others I could find no evidence of a second brood. On the other hand, it seems not improbable that a third brood is sometimes reared; but this needs confirmation. The starling's physical fitness for the struggle for supremacy is seen at once on an examination of its anatomy. It is a very hardy, muscular and powerful bird. It has the physical characteristics of a crow. It is exceedingly tough and wiry, and the bill, its principal weapon of offense and defense, is superior in shape to that of the crow. It is nearly straight, long, heavy, tapering, and nearly as keen as a meat axe, while the skull that backs it is almost as strong as that of a woodpecker. Mentally the starling is superior to the sparrow, and while brave and active in the face of any foe that it can master, it shows the acme of caution and intelligence in its relations with man or any other creature too powerful to master. While it is comparatively fearless where it is unmolested, it is always on guard, and if hunted becomes more wary than a crow. It is a handsome bird, and though it has little merit as a songster, it has many pleasant whistling and chattering notes and some talent as a mimic. Its alarm note is a harsh, rasping, low-pitched call.

Its insect-eating habits, its beauty and its cheery notes have already made it many strong friends in this country who will protect it stoutly; and this protection, together with the bird's ability to take care of itself and keep out of danger, precludes all possibility of its extermination here if it proves undesirable. Were rewards or bounties offered with a view to its extinction, blackbirds, meadowlarks and other native species, which consort with the starling, would be among the chief sufferers. The starling is here to stay, and we must make the best of it. Whether its presence will result in more good than harm will depend largely on the ratio of its increase. We now know enough of its habits in this country to forecast some of the results that may be expected from an excess of the species.

The Starling drives Certain Native Birds from their Nests.

When any animal is successfully introduced into a new country, and increases rapidly, its advent naturally tends to upset the biologic balance. Its native natural enemies have been left behind in its own country, where it had a settled and established place in a series of natural forces that had been in existence for centuries, and it becomes an interloper in the new land, among conditions and forms of life entirely new. If the species is weak or unfit for its new environment, or if it is introduced into a land differing much in climatic conditions from its own, it may die out; but if it is strong and fit, and if the climate is suitable, it is likely to increase abnormally in numbers, and it cannot so increase without displacing some of the species native to the soil.

The starling is a hardy, capable and prolific bird, which, like the sparrow, has had many centuries of experience in getting its living in populated countries and in cultivated regions in close relationship with man, and it has thriven in such an environment. It thus has an advantage over our native species similar to that enjoyed by the sparrow, which, subsequent to its introduction here, displaced so many native birds during the latter quarter of the nineteenth century. How can the bluebird or the house wren, which have been accustomed to life about human habitations for a comparatively short time, compete with such a bird as the starling?

The friends of the sparrow argued that it would fill a void in our city life that no native bird could possibly occupy, inasmuch as it would always have in the streets a plentiful supply of food that would otherwise be mainly wasted, and that it would be able to maintain itself where native birds would starve. No such argument can be advanced in favor of the starling. If there was an opening for the sparrow it was filled long ago, and the starling cannot occupy the place in our urban life now filled by the sparrow, even if it drives out the latter. No doubt in the city the starling is preferable to the sparrow, but it cannot displace the sparrow without indirectly making trouble for native species also. The sparrow and the starling will live together, as in England, but the starling will drive the sparrow away from all nesting places that are suitable for its own use, and the sparrow will in turn eject tree swallows, martins, bluebirds, wrens and other native birds from their present nesting places, that it may secure homes in place of those taken by the starling. Already this adjustment is going on. First in the city, then in the suburbs, and finally in the country our native birds which normally nest in hollow trees will be driven to the wall if the starling continues to increase in numbers, and there is now no adequate check to its increase in sight. In America as in Europe the starling seeks nesting places about buildings. It breeds in dovecotes, such church steeples as furnish safe nesting places, in holes and crevices about houses, in niches under the eaves, in electric light hoods, bird houses, nesting boxes, woodpecker holes and hollow trees. Therefore, in seeking nesting places it comes directly in competition with pigeons, screech owls, sparrow hawks, flickers and other woodpeckers, nuthatches, crested fly-catchers, martins, bluebirds, tree swallows and wrens, and as it extends its range to the west and south it must compete with other species. In the region already occupied it has proved itself capable of driving out all the above-mentioned species except the screech owl, which doubtless will prove its master.

In America the starling is not regarded as particularly pugnacious except where it has to fight for nesting places or for food. In such cases it is combativeness personified, and its attacks are well directed and long continued. Usually in its competition with the sparrow there is no fighting, for the sparrow soon learns that it is no match for the starling, and the contest degenerates into a straw-pulling match, each bird alternately clearing out the nesting material that the other brings. If the owner of the nest joins battle with the starling and fights stubbornly it is driven off, or it is sometimes killed in its nest. This daring interloper attacks birds much larger than itself, and the evidence shows that almost invariably it prevails in the end. The sparrow, the bluebird and the flicker have been credited with repelling it for a time, but eventually the starling wins, because of its increasing numbers, superior strength, courage and fitness. As the starling comes, native birds, whose nesting places it covets, must go, and many of these birds are more desirable than the starling. The skillful manner in which it evicts the flicker inspires the observer with a certain admiration for its superior strategy and prowess. The starlings quietly watch and never interfere while the flicker digs and shapes its nesting place in some decaying tree; but when the nest is finished to the satisfaction of the starlings it is occupied by them the moment the flicker's back is turned. On the return of the flicker a fight ensues, which usually results in the eviction of the particular starling then in the hole, which, however, keeps up the fight outside while another enters the hole to defend it against the flicker, which, having temporarily vanquished the first, returns only to find a second enjoying the advantages of possession. As Mr. Job says, the flicker is confronted with "an endless chain of starling," and finally gives up.[1]

In this or some other way the starlings, working together,

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[1] Job, Herbert K.: "Danger from the Starling." "The Outing." November, 1910, p. 149.

always succeed in driving the flicker from its home, in which they immediately begin to build. The moment the flicker gives up vanquished, the starlings molest it no more, allowing it to hew out another hole, either in the same tree or in one near by, when a similar fight ensues with more starlings; and so the flicker is driven literally from pillar to post, until it has prepared sufficient homes for the starlings in its neighborhood and all are satisfied, or until it gives up in disgust and leaves the vicinity of its aggressive neighbors. The principal spring work of the flicker in the future will be the preparation of nesting places for the starling. It is probable that the hairy woodpecker and the redheaded woodpecker also will serve as *carpinteros* for the interloper, but the downy woodpecker will be exempt from such service, as the entrance to its domicile is too small to admit the starling. There is no evidence that the starling has attempted to dispossess the screech owl; but Mr. Clifford M. Case of Hartford, Connecticut, states that he has seen a starling whip and drive away a male sparrow hawk. Many correspondents report that flickers, bluebirds, English sparrows and wrens have been driven from their nesting places in old orchards by the starlings.

Mr. Clifford H. Pangburn of New Haven says that his records show a considerable decrease in the number of bluebirds since the starlings came. There is no way to prevent this except in the case of the smaller species, such as wrens, chickadees, nuthatches, bluebirds and tree swallows, which may be protected against starlings (but not against sparrows) by providing them with nesting boxes having an entrance hole not over $1\frac{1}{2}$ inches in diameter.

At my request Mr. William H. Browning, who has many starlings occupying nesting boxes on his estate, put up in front of the entrance to one of them a small board in which a hole $1\frac{1}{2}$ inches in diameter had been bored. Starlings which then had young in the box were unable to enter. Mr. Job now assures me that starlings cannot enter a hole $1\frac{5}{8}$ inches in diameter.

The starling will compete with native birds for their food supply. Mrs. P. R. Bonner of Stamford has observed the intruder frequently attacking robins and other birds, and driving them away from a lawn where they formerly fed. The starling is a sphinx-like bird and ordinarily treats other birds with a sort of contemptuous tolerance. In winter it even permits robins, blackbirds and meadowlarks to join its great flocks, but as these flocks increase they must eventually clean up most of the winter food supply, and leave our native winter birds without sufficient sustenance.

Starlings killing Other Birds.

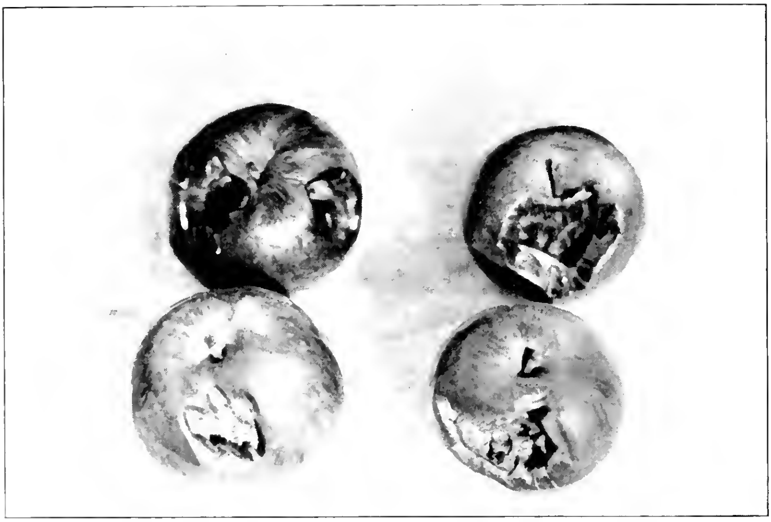
Two observers have reported the destruction of young and adult "English" sparrows by starlings, and two have noted the killing of native birds. There seems to be no reason to believe, however, that this habit has become general, and it seems more likely that it is exceptional; but this subject requires careful, painstaking investigation, and it is unsafe as yet to make predictions regarding it.

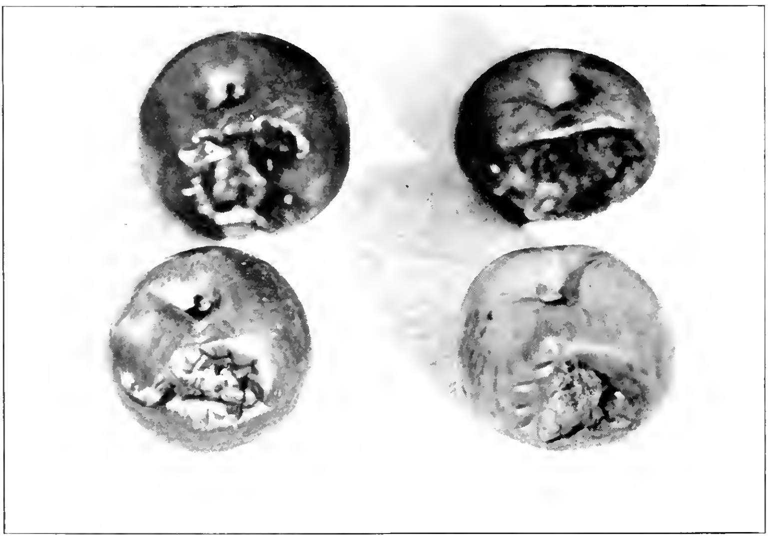
Other Injurious Habits of Starlings.

The food of the starling in America seems to be similar in general character to that which it consumes in Europe. It is particularly useful there, however, because of its fondness for the destructive land snails, which are very numerous in many regions.

It cannot be expected that it will be thus beneficial here, for we are not similarly afflicted in this country. The starling can give no service here that cannot be equally well performed by our own blackbirds, meadowlarks, bobolinks, sparrows and other birds, but it will be useful where these birds are not numerous enough to keep the insect enemies of grass lands in check. Already, however, the starling has begun to show a capacity for harmfulness which may be expected to become more prominent as its numbers increase. In the breeding season small flocks go to the cherry trees, and as they alight for a few minutes a shower of cherry stones may be heard. Sometimes they strip a tree completely and then go to another. In other cases they feed in a desultory way, taking toll from all the trees in a neighborhood.

Mr. William T. Davis of New Brighton, New York, describes the destruction of pears by starlings which he observed on





Apples ruined by the introduced starling (*Sturnus vulgaris*). (Original photograph from Billerica, Massachusetts.)

October 17, 1907, illustrating his statement by a reproduction from a photograph of two of the ruined pears ("Bird-Lore," November–December, 1907, page 267). Fully one-third of each pear was eaten.

Many observers state that the starling eats apples, but this habit appears thus far to be confined mainly to apples left on the trees late in the fall, after the crop has been gathered. Mr. W. S. Bogert of Leonia, New Jersey, asserts that it pecks open withered apples for the seeds. Nevertheless, it sometimes eats ripe fruit in the fall. Mr. Albert W. Honywill of New Haven, Connecticut, has seen starlings eating apples, and Mr. James D. Foot of Rye, New York, states that they will alight in an apple orchard and take a peck or two at the finest fruit.

In September, 1914, on the farm of Mr. William P. Wharton at Groton, Massachusetts, I saw apples that apparently had been pecked and ruined by starlings which had summered in the vicinity. Later, complaints of similar injury were received from Billerica. Mr. Walt F. McMahon gathered there on the farm of Mr. E. F. Dickinson a number of apples which had been pecked by starlings, some of which were photographed for the illustration facing this page. It will be seen that the birds take only a little from the ripest part of each fruit.

Flocks sometimes descend on a strawberry bed and considerably reduce the crop.

In the fall, when starlings gather into large flocks of a thousand or more, they are often very destructive to corn in the ear. In Europe they feed to some extent on small grains, but I have not seen any evidence of that here. In New Jersey in the month of June they seemed to prefer the cherry trees to the wheat fields, and did not appear to molest the wheat at all. A few gardeners claim that they pull sprouting corn and eat peas. Mrs. Frank L. Allen of West Haven, Connecticut, asserts that she watched the starlings destroying her lettuce and radishes. Sometimes they have the habit of pulling up young plants.

Mr. Alfred C. Kinsey writes that he noticed the parent birds supplying nestlings with what proved to be the staminate flowers of the hickory. Later on, in different localities, the same peculiarity was noticed. If such feeding becomes extensive it will bring about a failure of nut crops. He has also noticed these birds on grape vines and in trees wantonly tearing off large pieces of leaves, as well as doing damage to various fruit crops. Some observers assert that the starling also destroys the buds of trees, but I have been unable to get definite evidence on this point.

Food of the Starling.

Examination of the stomachs of 102 starlings collected mainly in June, 1910, 41 of which were nestlings, seems to show that the food of the starling in this country is similar to that taken by it in Europe. The contents of these stomachs were examined by Professor F. E. L. Beal of the Biological Survey. It must be remembered that the number of stomachs is comparatively small, and that they were taken in a single month, and therefore no conclusions regarding the value of the starling to agriculture can be drawn from their contents. Nevertheless, a brief report of the result of the examination is of interest in this connection. The proportion of animal food is very large and consists chiefly of insects. Only 3 birds had taken earthworms, which composed 17.33 per cent of their stomach contents; 18 birds had eaten both millipeds (or thousand legs) and spiders; 22 had taken millipeds but no spiders, and 18 had eaten spiders but no millipeds. The average percentage of millipeds in 22 stomachs was 39.89 per cent.

Caterpillars represent the largest items of insect food. Fifty-two birds, or more than half the number taken, had eaten caterpillars, which formed over 45 per cent of their stomach contents. These appeared to be mainly, if not entirely, hairless larvæ, among which Geometrids, or inch worms, were recognized. Probably a large percentage of these caterpillars were Noctuids, or cutworms, as I frequently recognized cutworms in the bills of the parent birds when they were feeding their young. Very few moths were noted in the stomachs, but some tineid cocoons were found in one. *Datana ministra*, an apple tree pest, was recognized in 1 stomach.

More of the birds had taken beetles than had eaten caterpillars; but the beetles formed a smaller average percentage of the food. Fourteen had taken Elaterids (commonly known as snap beetles) or their larvæ (wire worms), which formed 10.92 per cent of their stomach contents. The larvæ of these beetles (wire worms) are well known to agriculturists as destructive to grain and garden crops, but many native birds eat them. Carabidæ, or ground beetles, were represented in 42 stomachs. While these beetles are generally regarded as useful insects, some of them have been known to become injurious where they have increased abnormally, therefore their destruction cannot be set down as altogether to the discredit of the starling. The genus *Calosoma* is represented in 1 stomach. This genus is believed to contain only beneficial insects. One bird had taken some Lampyrids. Three had taken *Leptinotarsa decemlineata*, the Colorado potato beetle, which formed 16.67 per cent of the stomach contents. If the starling acquires the habit of eating Colorado potato beetles it may be a help to the farmers in this respect, as few native birds eat them. Eleven starlings had taken a few scarabæid beetles, which formed on the average 8.54 per cent of the stomach contents. Weevils were represented in 28 stomachs, and constituted 7.07 per cent of their contents. Beetles of the genus *Lachnosterna*, commonly called May beetles, or their larvæ, commonly known as white grubs, were represented in 13 stomachs, and comprised 14.53 per cent of their contents. These beetles are very destructive, as the white grub feeds on the tubers and roots of plants. This genus is one of the well-known enemies of grass and garden crops, but many of our native birds feed upon all forms of these beetles. Two birds had taken chrysomelid beetles, which feed on the foliage of trees, but they formed only 2 per cent of the stomach contents of these two birds.

Orthoptera are represented by grasshoppers in 17 stomachs, forming 19.88 per cent of their contents. There were a few crickets. This is rather a small showing, as practically all birds eat grasshoppers, but probably a larger proportion of grasshoppers would have been found had the birds been taken later in the season.

Hemiptera, or bugs, were found in only 3 stomachs, and Diptera in only 1, the proportion of each being very small. Hymenoptera were found in 17 stomachs. This order was represented mainly by ants. It seems probable that the starling does not destroy many of the useful parasitic flies of this order.

The nestlings were fed with food similar to that taken by the adults, but they were given a larger proportion of young, or larvæ, such as caterpillars and other soft-bodied insects, while the adults fed more on mature beetles and similar hard-bodied insects.

The vegetable food consisted very largely of fruit. The birds were taken during the cherry season, and 18 stomachs contained an average of 56.17 per cent of the skin, pulp and stones of cultivated cherries. In 7 cases the skin or pulp of fruit, which could not be fully identified, composed 31.71 per cent of the stomach contents; mulberry seed and pulp in 9 cases composed 35 per cent of the stomach contents, and grape pulp composed the greater part of the stomach contents in 1 case. This grape pulp must have been secured from greenhouse fruit. Possibly an investigation of the stomachs of starlings during the grape season would reveal a much larger percentage of this fruit. Only a few nestlings had eaten fruit. A few stomachs contained fragments of grasses, which may have been taken accidentally in procuring insect food. Portions of vegetable stems also were found. A few seeds of *Polygonum*, *Rhus radicans* and other plants suggest that later in the season seeds and wild fruits may form a larger proportion of the food of the starling.

Among the miscellaneous substances found was a portion of some small crustacean and a bit of shell. Fifteen stomachs were empty and 3 nearly empty. Some of these starlings were taken on the roost at night, at or before 8 o'clock, and as the birds were feeding until about 7 o'clock, and as they usually go to roost with a full stomach, it is fair to assume that the digestion of the starling is rapid enough to empty its stomach within an hour.

Conclusion.

The starling is hardly numerous enough yet in Massachusetts to do much injury to fruit crops, vegetation or native birds. Thus far it is mainly beneficial here, as it does some good by destroying noxious insects. Under our laws it is now (January, 1916) protected at all times, but if its numbers increase unduly, as they probably will, it may be necessary to deny it the legal protection now afforded to insectivorous birds.

Since the above was written, a canvass of the State has been made and starlings have been reported from every county, even from Nantucket, where they were unknown until 1914. Their pioneers have explored the country and have decided upon their locations. We may expect a great increase in the starling population in a few years.

An entomological collector near New Haven, Connecticut, complains that certain insects of grass lands are scarce and hard to find since the starlings have become numerous. Such a reduction of grass insects will cause no complaint from the farmers. Nevertheless, those who raise cherries and strawberries cannot appreciate the benefits to be derived from the starling, and some States already have removed the protection of the law from it.

Perhaps it is too early yet to say what will be the final result of the introduction of the starling into this country. Its value as an insect destroyer is plain, but its unchecked increase may prove a calamity to several species of useful native birds, and from the experience of other countries we may assume that it is likely to become a pest to the fruit grower.

Owners of apple and cherry orchards may be able to keep the birds away from their fruit by employing boys to frighten them by clapping boards together or firing Roman candles, rockets or even guns. There is little danger to the starling in any of the farmers' efforts to shoot it, as the bird is more likely to be scared than hurt. Owners of a few trees who cannot afford to hire help may be obliged to cover their trees with fine fish net, or lose their fruit.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 46.
(Supplanting Nature Leaflet No. 2.)

THE TENT CATERPILLAR.

By H. T. Fernald.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1915.

Approved by
The State Board of Publication.

THE TENT CATERPILLAR.

(*Malacosoma americana* Fab.)

HENRY T. FERNALD, PH.D., STATE NURSERY INSPECTOR.

This was an unusually common insect in Massachusetts during 1913 and 1914, its whitish webs being present in large numbers during the spring and summer months. A few of the webs may be seen every year, but sometimes the insect becomes very abundant for two or three years, after which for some time it is only occasionally noticed. The caterpillar feeds on

the leaves of the wild cherry and apple by preference, though it is sometimes met with on the peach, cultivated cherry, hawthorn and other thorns.

The eggs are laid by the adult moth, usually in July, in bands around the smaller twigs of the trees the caterpillars feed upon, and are then covered by a dark brown shiny substance which protects them from the weather. These egg masses remain in this condition until the following spring, hatching about as, or just before, the leaf buds open. The tiny caterpillars crawl from the egg cluster where they hatched to a fork of the tree near by, and there spin a web of whitish silk in which to live. From this they go out to the leaves each day to feed, spinning a thread as they go, and following this thread back to the tent again as night comes on. They are liable to hatch so early in the spring that the opening buds provide the only food available, and from them they pass to the leaves as these develop. As they grow they increase the size

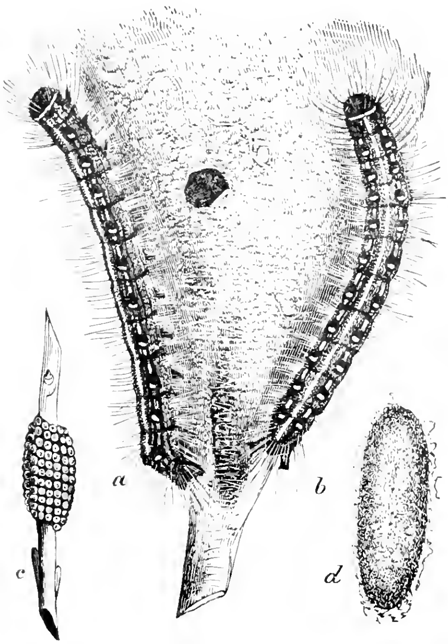


Fig. 1.[1] — (*a*) Side view, (*b*) back view of common tent caterpillar; (*c*) eggs, and (*d*) cocoon.

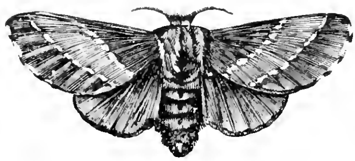


Fig. 2.[1] — Moth of common tent caterpillar.

of the tent so that all can remain inside at night, and by the 1st of June it may be a foot or more long and perhaps half as wide at its widest point.

By the middle of June, or sometimes earlier, the caterpillars have become full grown. They now leave the tent and crawl off in different directions, seeking protected places in which to make their cocoons. These may be found on walls, fences or in other shelters, and are oval, yellowish, closely woven masses of silk about an inch long. Within this cocoon the caterpillar

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[1] These illustrations, obtained through the courtesy of Mrs. C. V. Riley, are from Riley, 3d Missouri Report, 1870.

changes to a dark brown pupa which transforms to the adult moth. When this change has been completed — about two or three weeks — the adult moth escapes, and the eggs for the next generation are laid. As the moths fly only at night they are seldom seen. There is only one generation a year.

Enemies.

A number of kinds of birds feed on this insect in the caterpillar stage, and several kinds of bugs destroy them by capturing them and sucking out their juices. Parasites lay their eggs in or on them, and the young parasites which hatch from these eggs feed on the internal organs of the caterpillar, the adult parasites sometimes appearing after the caterpillars have gone into the pupa stage.

Treatment.

Collection of the egg masses at any time between July and the following spring, and their destruction by burning, is one method of combating this insect, and in times of great abundance is very useful. In general, however, spraying the trees, just as the leaf buds begin to open, with 3 pounds of arsenate of lead paste (or $1\frac{3}{4}$ pounds of powdered arsenate of lead) in 50 gallons of water is an easier method of control. If, as is frequently the case, the leaf buds begin to open while the tree is in blossom, the spraying must be put off until after the blossoms have fallen. This spray will then also be the one used against the codling moth, and in this way the sprayer will "kill two birds with one stone."

If for any reason tents are found, and spraying as just described cannot be given,. the tents while yet small can be crushed with a gloved hand in the evening when the caterpillars are at home. The use of a torch to burn out the tents is not a good practice, as many of the caterpillars drop to the ground when they first feel the heat, and later crawl up the tree and start again; and also because it is easy to hold the torch at the fork where the tent is too long, and so injure the tree that later, under the weight of the fruit, a bad split will develop.

Wild cherry trees along roadsides and elsewhere are favorite places for tent caterpillars. As these trees are of no value they should be cut and burned so that no food shall be available for the caterpillars.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 47.

April, 1915.

BIRD HOUSES AND NESTING BOXES.

EDWARD HOWE FORBUSH.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1915.

Approved by
The State Board of Publication.

PLATE I.

FIG. 1. — Martin box, made by Mr. J. Warren Jacobs of Waynesburg, Pennsylvania. This forms part of a nesting colony on the estate of Mr. Edward L. Parker at Concord, Massachusetts. (Original photograph.)

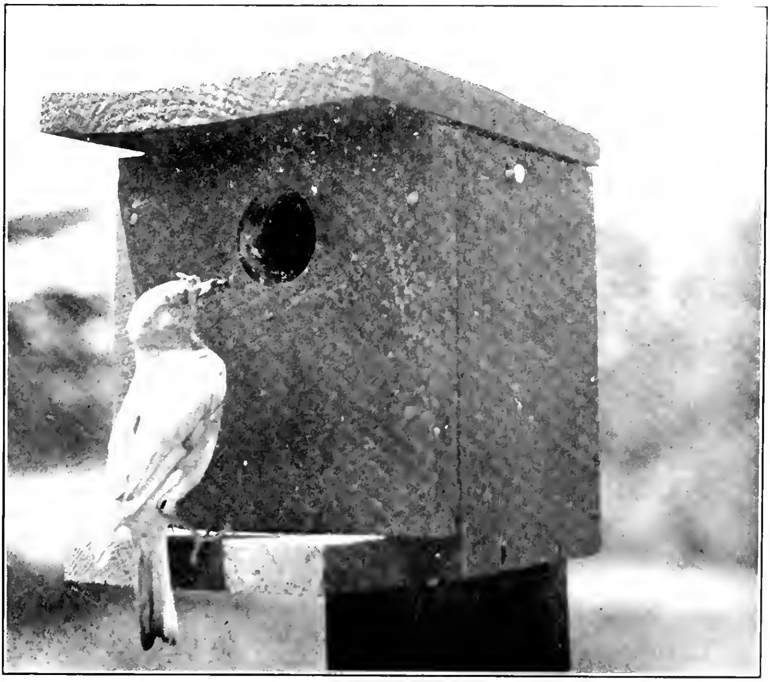


FIG. 2. — Swallow box, made by Mr. E. C. Ware, Wareham, Massachusetts. Male bluebird bringing insects to its young. (Original photograph taken on the author's farm.)

BIRD HOUSES AND NESTING BOXES.

EDWARD HOWE FORBUSH, STATE ORNITHOLOGIST.

Many people fail to put up bird houses or nesting boxes because of the trouble and expense entailed, or because they do not know how to prepare and erect them in such a way as to get the birds. Much that has been written on this subject has been theoretical. Fatal errors in the dimensions of entrances have been disseminated. For want of specific instructions, nesting boxes have been put wrong side up or in places where no bird would use them.

This circular has been written to encourage people to construct easily made, inexpensive nesting boxes, and to tell them where and how to put them up so that the birds will be sure to take them. Making and putting up such boxes should be looked upon as a pastime. They need cost little or nothing, and he who makes them should feel well rewarded by the joy of seeing the little tenants choose, settle down, build their nests and rear their young, singing their cheery songs meanwhile, and feeding on the insect enemies of crops and trees. We must provide homes for the birds that nest in hollow trees, as there are no longer holes enough to go round, while destructive insects have so increased in numbers that the food supply is abundant.

A plentiful supply of nesting boxes properly put up will increase the number of birds in a locality by multiplying the bird families reared, and boxes rightly situated give much better protection to the young than most tree cavities. A bird box is serviceable if it furnishes a suitable nesting apartment, shelters nest, eggs and young from sun, wind and storm, and provides security against the birds' enemies. Also it may serve in winter as a night shelter or sleeping place for a woodpecker or a party of nuthatches or chickadees. We must allow the birds to be the judges of what they want, as they and not we are to be suited. Therefore in building a nesting box it is well to inquire first what kind of a home the bird naturally chooses.

As the hollow trunk or limb, or the abandoned woodpecker's nest, is the usual domicile chosen by the hole-nesting birds, it is natural to conclude that they will prefer something closely resembling nature's accommodations. For this purpose a section of a tree, containing an old nest of a woodpecker may be taken, or hollow limbs, pruned from apple or other trees, may be sawed into sections about a foot in length, the lower end of each plugged, and the upper end covered with an overhanging piece of board sloping to the front. A hole may be bored in the front of this contrivance for an entrance, and a piece of board may be nailed on the back (Fig. 1), so that the box when finished may be nailed up to a tree, post or pole. The hollow of the limb should not be less than $3\frac{1}{4}$ to 4 inches in diameter at the bottom, and 6 to 8 inches in depth below the entrance. The deeper the box and the higher the hole under the overhang of the roof, the less chance there will be for cats, jays and the other larger enemies of birds to reach the eggs or young. Perches are not necessary. Some birds like them, but they give the enemies of the birds the advantage of a better foothold.

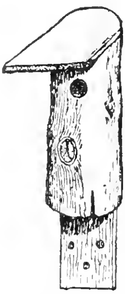


Fig. 1. — Hollow limb.

Neat boxes may be made of slabs with the bark on (Fig. 2), but all bark left on bird houses should be firmly nailed on, as otherwise it will come off sooner or later. In "Bird Lore" for January–February, 1905, I described the method of making bark boxes, but at that time they were untried. They have since had nine seasons' trial, with very satisfactory results. To Mr. William Brewster belongs the credit of their invention, and I have made a considerable number after his design. White birch and chestnut were used, as it was believed that the bark of these trees would be most durable, but Mr. Brewster suggests that elm bark is probably best of all. Those portions of the trunks used were from 4 to 8 inches in diameter. The boxes were made in summer, as the

Fig. 2. — Slab box.

PLATE II.

FIG. 1. — A nesting box made from roofing felt by Mr. Winthrop Packard of Canton, Massachusetts. (Original photograph taken on farm of Mr. William P. Wharton, Groton, Massachusetts.)

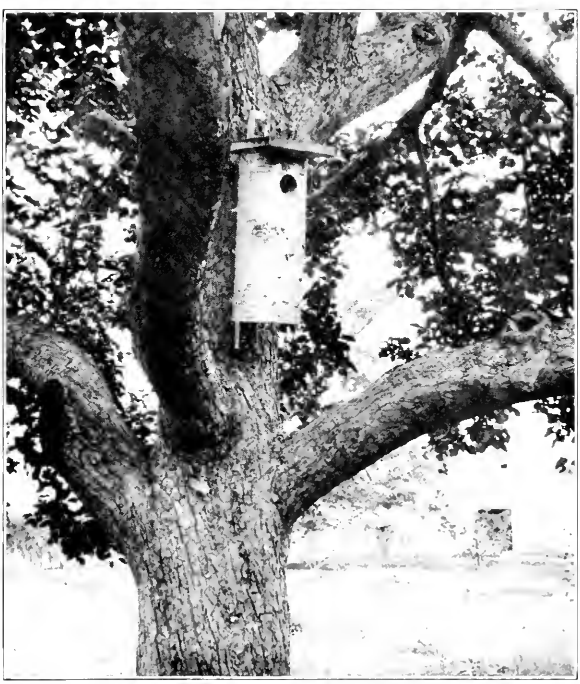


FIG. 2. — Berlepsch nesting box, made of birch after the plans of Mr. Ernest Harold Baynes of Meriden, New Hampshire. This style has proved acceptable to woodpeckers and nuthatches. (Original photograph taken on the farm of Mr. William P. Wharton at Groton, Massachusetts.)

bark will not usually peel much earlier than June 20, and then only for a short time. When the tree had been cut down, the trunk was sawed into sections from 10 to 18 inches long, according to the size of the boxes desired. Only straight sections, free from knots or branches, were used. A limb of the right size, however, may, when cut off, leave a hole in the bark that can be utilized as an entrance for the birds.

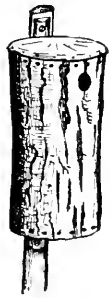


Fig. 3.—Chestnut bark box.

These domiciles may be made as follows: an incision is made on the side intended for the back of the box, through both outer and inner bark, from the top to the bottom of each section; then, on the opposite side, some two or three inches from the top, there is bored through the bark, with an auger or extension bit, a hole of the size desired for the entrance. If such tools are not at hand, the aperture may be cut with a gouge, a chisel, or even a knife. Next insert a wedge-shaped stick into the incision at the back and under the inner bark, to start it off, and with this implement peel it very carefully. In peeling birch one should be careful not to separate the inner and outer layers of the bark. Caution should be used when working about knots or rough places. The bark will make the sides of the box, and two sections, each an inch thick, sawed from the ends of the barked log, will make the top and bottom. Now the bark is tacked to the bottom and top. The bark will draw apart somewhat at the back in drying, but this aperture may be covered, when the box is put up, by nailing or screwing a short stick or pole over the opening on the back, which stick in turn may be nailed or screwed to the supporting tree, building or pole. To make the roof watertight, a piece of cotton cloth, duck or denim may be put on, tacked down over the edge and painted, or a piece of roofing paper may be used. A more permanent covering may be made by using a piece of tin or zinc, as shown in the figure of the chestnut bark box (Fig. 3). To make the expected nest accessible to examination, the top of the bark sides might be fastened to a hoop, and the

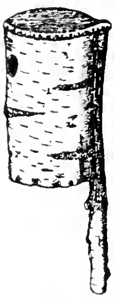


Fig. 4.—Birch-bark box.

whole capped by a tin or wooden cover, like that of a lard pail or a berry box. Mr. Winthrop Packard makes a very pretty box of roofing felt. (See Plate II., Fig. 1.) The best support is a slim pole.

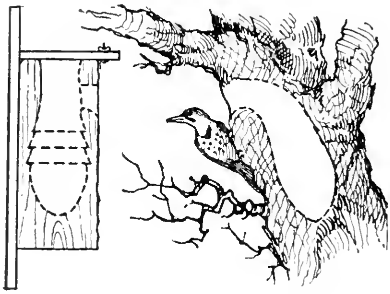


Fig. 5. — Berlepsch box and flicker hole.

Large wooden conductors, used to carry water down from the eaves of large buildings, may be obtained from some dealers in lumber or moldings, sawed into sections, and utilized precisely as in the case of hollow limbs.

Baron Hans von Berlepsch of Seebach, Thuringia, Germany, has invented a device for making nesting boxes similar in shape to the nesting holes of woodpeckers, and he has been wonderfully successful in attracting all hole-nesting German birds to these boxes. (Fig. 5 and Plate II., Fig. 2.) The theory on which they are built is admirable, but after three years' trial of them in this country I am convinced that most Massachusetts birds do not prefer them to the hollow limb or even to the rectangular box (Fig. 6) that many people have used with great success. The von Berlepsch style of box may be better for typical woodpeckers, such as the hairy and downy woodpeckers. Mr. Ernest Harold Baynes reports two cases where downy woodpeckers have nested in these domiciles; but flickers and red-headed woodpeckers nest in rectangular boxes. This latter type of box is excellent for bluebirds, chickadees, wrens, flickers and tree swallows. If made 18 inches deep for bluebirds it will be very nearly cat proof. The smaller sizes of the von Berlepsch type have been made and sold in Germany for about 25 cents each, but here they cost about $1. A very fair temporary substitute may be made by growing gourds which,

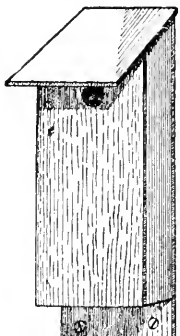


Fig. 6. — Cat-proof box.

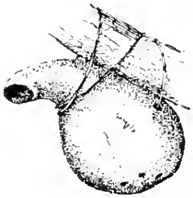
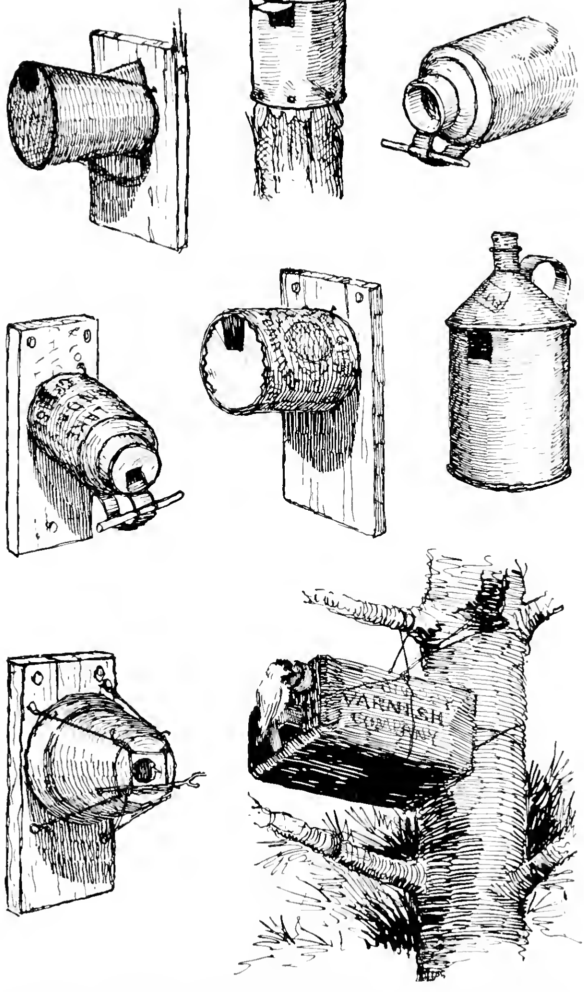


Fig. 7. — Gourd.

PLATE III.



Worn-out cans and utensils for nesting boxes. They may be nailed or wired to posts or trees, and should be so placed as to be shaded from the sun in the hottest part of the day.

when the contents have been removed, are acceptable to many birds if tied upon poles or trees (Fig. 7), but they are not so durable as well-made wooden boxes, and I have not had much success with them.

My first nesting boxes, all of which were successful, were made of old shingles, picked up from the ground when the barn was reshingled, and some pieces of old weathered boards removed from the ridgepole at that time. A square section about $3\frac{1}{2}$ inches in diameter was sawed from the ridgeboard for the top of the box, and another 4 inches wide was used for the bottom, the shingles being nailed to them (Fig. 8). A saw, hammer and jackknife and a few nails were the only tools and materials required. I have made such a box in twelve minutes. These boxes were nailed up in elm, cherry and apple trees, and some happy families of bluebirds were raised, until at last the cats discovered them. A large number of shingles may be saved when a building is reshingled, and every year at the end of the season the old boxes may be taken down and burned to do away with vermin, gypsy moths, etc., that may be concealed within. It takes but a short time to make more. Tin cans and flowerpots are not quite so suitable for nesting boxes as are wooden receptacles, because pottery and metal are good conductors of heat, and unless put up in the shade are likely, in very hot weather, to overheat the young birds. Nevertheless, if such utensils are placed where they will be in the shade during the hotter part of the day they may be used with success (Plate III). Cheap, thin boxes, such as the larger cigar boxes, may be fastened up inside a barn under the eaves and a hole bored through the wall of the building into each box, or a box may be made for this purpose (Fig. 9).

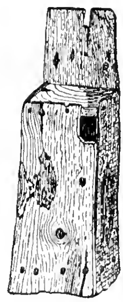


Fig. 8.—Shingle box.

Many people write me anxiously asking of what size nesting boxes should be made and begging for exact dimensions; some are unhappy lest the entrance holes face the wrong way; others are anxious about ventilation; others feel sure that the smell of paint on the nesting boxes or bird houses will drive the birds away, while still others fear that they may get the box too high or too low; but all these things make very little difference. The situation, environment, and size of the entrances, however, are important. I have known tree swallows to nest in a round box $3\frac{1}{2}$ inches in interior diameter, in a flowerpot even smaller at the bottom, and in a one-apartment bird house, nearly a foot square and about 18 inches high from floor to ridgepole (Fig. 10). This is one of the most popular houses with tree swallows. But why waste enough lumber on one bird house to make three nesting boxes? I have tried facing the entrance hole to all points of the compass. The birds used them all. Painted or unpainted, weathered or unweathered, wood, bark, cement, tin, clay, papier maché and roofing felt, — all have been chosen indiscriminately by feathered house hunters. Boxes placed 6 feet from the ground and others set on poles on the roofs of tall city buildings have been taken. I have seen chickadees nesting in a hole in a birch stump 2 feet from the ground and in the hollow branch of an elm 65 feet up. One wood duck settled in a hollow apple tree 3 feet from the ground, and another 40 feet up in a hollow elm. Such experiences lead us to revise our opinions regarding the exact size of the tenement each bird requires and how high or low it should be situated. I am not so positive as I once was regarding what is best for certain species or what kind of a box or situation will best please each one. It seems that the birds have some individuality, or that they need nesting places so badly that they will take almost anything

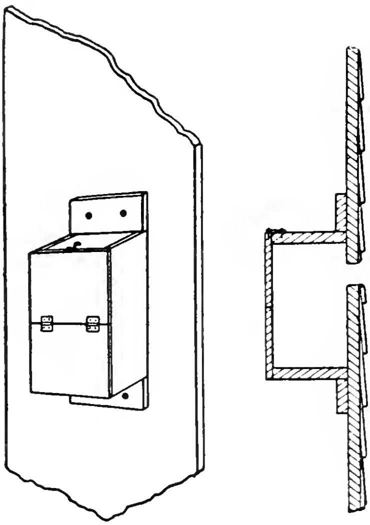


Fig. 9. — Box inside a building. (From Biological Survey.)

Fig. 10. — Swallow house.

if it is so situated that it offers peace and safety. Nevertheless, there are a few rules that it is best to follow in making and erecting bird houses to secure the best results: —

1. Let the roof be made tight and overhang the entrance enough to carry rain clear and keep the sun from shining in on the young.

2. Do not make the bottom of the box too tight. If any rain drives in it should run out.

3. If the box tips forward a little on the side of the entrance hole when set in place it will shed rain well. It should never lean backward.

4. Provide a way of opening the box quickly unless you intend to burn it and replace it after the first season, as is done sometimes with gourds and shingle or bark boxes.

5. Make the entrance hole and the box itself just large enough for the bird you want — no larger. This will tend to keep out larger birds, as well as the birds' enemies, will give the bird a better chance to defend its home, and will save material.

6. Make nesting boxes of weathered wood, or paint or stain them with colored linseed oil of a neutral tint resembling dead wood or bark, or put them up in the fall that they may become weather-stained before spring. Apparently birds are less suspicious of such boxes than of those made of new, bright lumber.

7. Fix nesting boxes on buildings or on poles rather than on trees, and make them inaccessible to cats, squirrels, mice and rats.

8. Where it seems best to put them in trees, choose isolated trees which can be protected against cats, squirrels, weasels, etc.

9. Ordinarily ventilation is unnecessary if the entrance is near the top of the box as it should be, but in very hot summers young birds are believed to have died of heat in unshaded boxes mounted on poles. Ventilation may be provided by boring 4 half-inch holes in the sides of the box near the top and filling them with corks which may be removed in extremely hot weather.

A few practical details in regard to carrying out some of the above rules should be noted.

If the roof of a nesting box, made of wood, is horizontal, the water will stand on it, and even if painted it will warp somewhat in drying unless covered with zinc, good roof paint, some good roofing felt or other waterproof material. It is well to have a crosspiece nailed (with clinch nails) across the grain on the under side to prevent warping and splitting. If the top slopes downward at an angle of 45° or less and is painted, the water will run off so fast that the roof will not warp much.

Top, side or front of the box may be hinged to open as a door, or fixed to fasten by means of nails, easily removed, slid loosely into sockets arranged for them. White pine from $\frac{1}{2}$ to $\frac{7}{8}$ of an inch thick is the best lumber. Cedar and cypress are durable. Grocery or drygoods boxes may be used. The following dimensions will do for flat-roofed dwellings for the birds named. These dimensions are not absolute, but are such as seem to be popular with the birds. The boxes may be made larger if desired, but not very much smaller. The size of the entrance, however, should not be changed. If the roof is not level but slopes forward the back may be two or three inches higher.

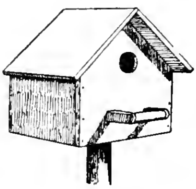


FIG. 11. — Wren house.

House Wren. — Interior dimensions, 6 by $3\frac{1}{2}$ by $3\frac{1}{2}$ inches. Entrance hole, $\frac{7}{8}$ inch in diameter. The long axis may be either horizontal or vertical and the entrance hole near the top. A miniature bird house (Fig. 11) will do as well, but takes more time to make.

White-breasted Nuthatch. — A box actually occupied by this bird on the grounds of the Rev. William R. Lord, at Dover in 1914, measured 5 by 5 inches (inside dimensions). Height, 12 inches front; $13\frac{1}{2}$ inches back. Long axis vertical. Entrance front, near top, $1\frac{1}{2}$ inches in diameter (Fig. 12). Probably a box made of bark, or slabs with bark on, would attract this bird.

Red-breasted Nuthatch. — This bird has nested in a No. 2 Berlepsch nesting box made of yellow birch by the Meriden Bird House Company, Meriden, New Hampshire, and placed in a gray birch tree, in rather open land, with the entrance slightly more than 7 feet above the ground. The entrance hole is $1\frac{1}{8}$ inches in diameter.

PLATE IV.

A nesting box occupied by the crested flycatcher. (Photograph by Mrs. J. W. Elliott, Needham, Massachusetts.)

This is reported by Mr. H. S. Shaw, Jr., of Dover, Massachusetts, and is the only case, so far as my records show, where a red-breasted nuthatch has nested in a bird box.

Chickadee. — A box like Fig. 5 or Fig. 12 may be used, 10 by 4 by $3\frac{1}{2}$ inches inside dimensions. Long axis vertical. Entrance

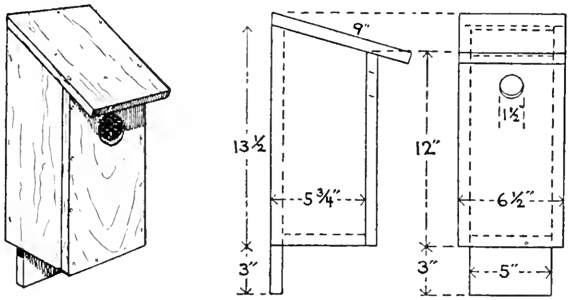


FIG. 12 — Box used by White-breasted Nuthatch.

hole $1\frac{1}{4}$ inches diameter, placed near top of box (Fig. 13). Others recommend an entrance $1\frac{1}{8}$ inches in diameter, or less, but my experience goes to show that our chickadee, like the European titmice, prefers an opening a little larger than it needs, which

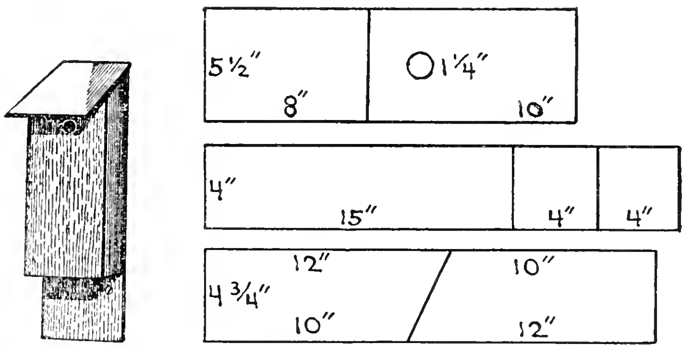


FIG. 13. — Chickadee box and details of construction.

makes the chances of success better with the larger entrance. Many boxes for this bird have been made with the entrance too small. They are rarely if ever used.

Bluebird. — Interior dimensions, $4\frac{1}{4}$ by $4\frac{1}{4}$ by $9\frac{1}{4}$ inches. Entrance, $1\frac{1}{2}$ inches or an eighth less — never $1\frac{1}{4}$ inches, as most bluebirds will not enter a hole of this size. Long axis vertical (Fig. 14). Tree swallows will use this.

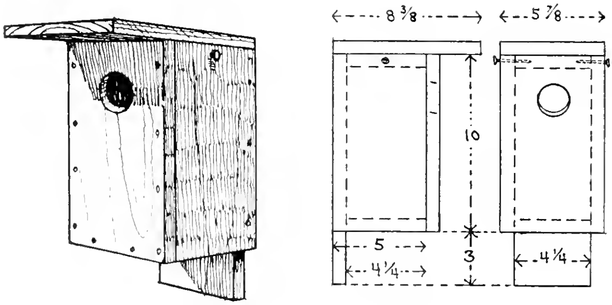


FIG. 14. Bluebird box and details.

Tree Swallow. — Interior dimensions, $4\frac{1}{4}$ by $4\frac{1}{4}$ by 8 inches. Entrance hole about, not over, $1\frac{1}{2}$ inches. Long axis vertical. Bluebirds also use this box. (See Plate I., Fig. 2.)

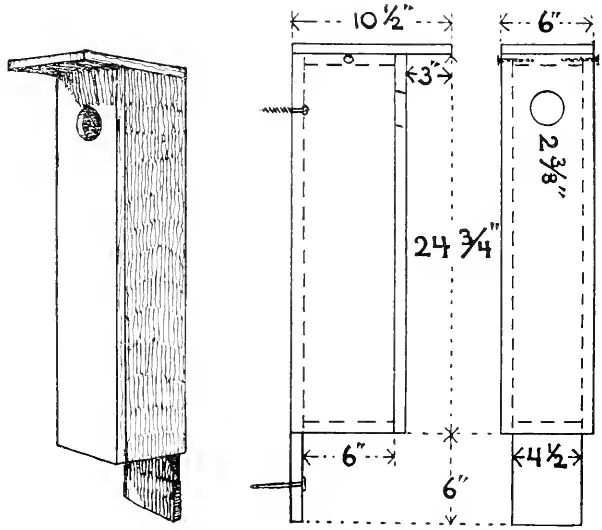


FIG. 15. — Flicker box and details of construction.

This is the most popular box (with the birds) that I have seen.

Starling. — This European bird will soon be common and may become a pest. It requires an entrance hole about 2 inches

PLATE V.

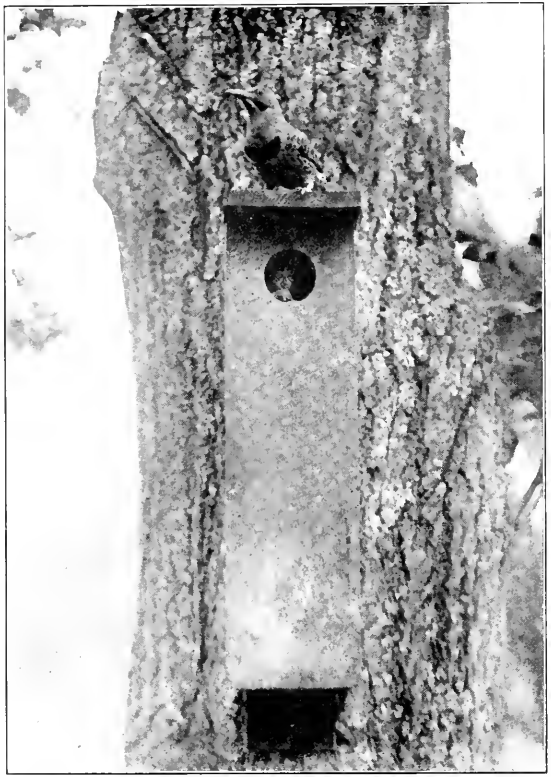


Fig. 1. — Male flicker on nesting box with young bird looking out. Box made by Mr. E. C. Ware of Wareham, Massachusetts. (Original photograph.)

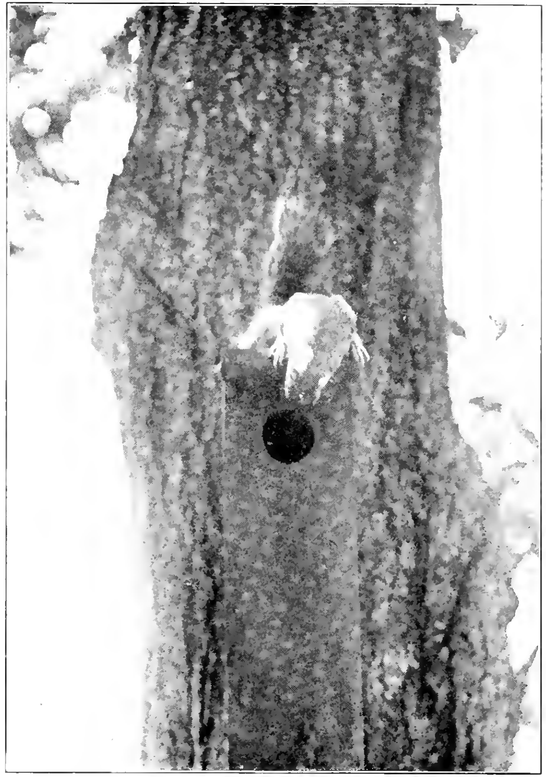


Fig. 2. — Gray squirrel about to enter flicker's nesting box. Squirrels drive birds from nesting boxes. (Original photograph.)

in diameter, and cannot enter boxes properly made for bluebirds or smaller birds. It will use any tenement suitable for martins, flickers, crested flycatchers or sparrow hawks, such as are described and figured hereafter.

Crested Flycatcher. — Measurement of box actually occupied, interior diameter, 6 by 6 by 8 inches. Long axis horizontal. Entrance, 2 inches in diameter. (See Plate IV.)

Flicker. — Interior dimensions about 22 by about 6 by $4\frac{1}{2}$ inches. Long axis vertical. Entrance hole at least $2\frac{1}{2}$ inches in diameter, near top. Several inches of ground cork or coarse sawdust and dry earth mixed must be placed in the bottom, as woodpeckers make no nest but rely on rotten wood or chips which they strike off the tree to make a bed for their eggs. (See Figs. 15 and 16 and Plate V).

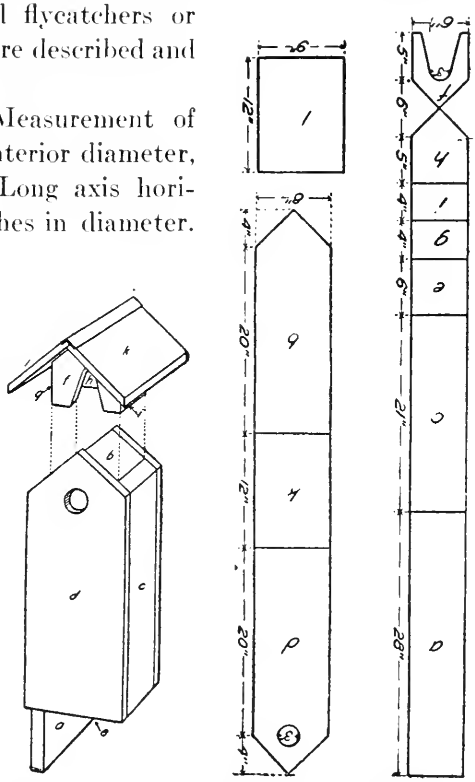


FIG. 16. — Flicker box and details. (After Biological Survey).

Sparrow Hawk. — Flicker boxes have been used occasionally by sparrow hawks, but a more roomy box, at least 8 inches in diameter would be better.

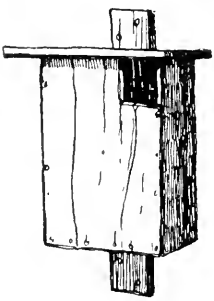


FIG. 17. — Owl box.

Screech Owl. — Inside dimensions of box actually occupied on my place in which young were raised, 7 by 11 by 15 inches. Long axis vertical. Size of entrance hole, 3 inches wide by 4 inches high. (Fig. 17.)

Wood Duck. — Inside measurements, about 10 by 10 by 24 inches. Entrance, 4 inches in diameter and 18 inches from the bottom. Long axis vertical.

Robin. — The robin uses mud as a framework for its nest, and as this makes the nest heavy it requires a good foundation and a roof over it to render it weatherproof. Robins' nests often are dislodged or blown down in storms, and sometimes the birds, warned perhaps by experience, learn to place their nests on some projection under the eaves of a house porch or summer house; on the end of a projecting log under the eaves of a log house; on a beam under the roof of a shed or railway station; under a bridge; under the overhanging sod on the edge of a bank; in a hollow trunk; in a barn cellar; or even in a bird house. Mrs. Mabel Osgood Wright experimented years ago with shallow wooden trays about 6 inches square, bracketing each one to a post, grape arbor or building, always with a branch, eaves, arbor or other screen or protection overhead. The robins did not use them the first year. The second year two were used, and the last year five others. These trays should be made so that they will not hold water. A small grape basket hung or nailed up under projecting eaves or a shed roof may be used by robins, swallows or phœbes, particularly if a little hay is placed in it. A pair of Carolina wrens at Fairhaven nested in such a basket partly filled with dynamite hung under the ridgepole of a barn.

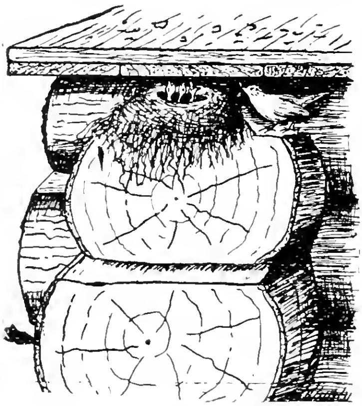


Fig. 18. — Robins' nest on log cabin.

Fig. 19. — The old cider mill.

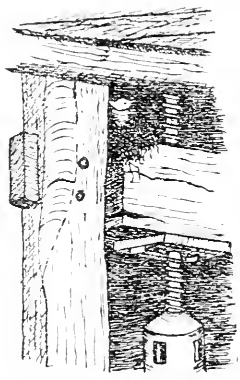
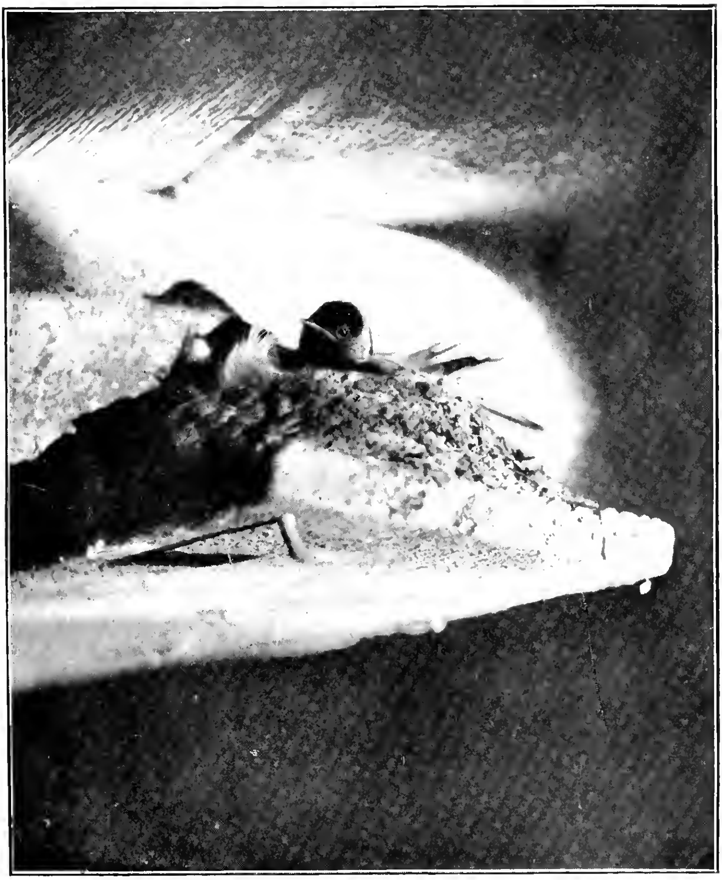


Fig. 20. — Robins' nest on the cider press.

PLATE VI.



A plan for attracting swallows. Barn swallow on nest on projecting end of a board in barn three feet above the back of a stalled cow. The bird chose the situation because of the resting place offered for the nest. (Original photograph taken by reflected light.)

Phœbe. — Any little open box or shelf, put up under the eaves of a building or under the roof of any open shed or porch, may be used by phœbes (Fig. 21). This makes a safe support for their nests which often is appreciated by the bird. Phœbes rarely nest far from water.

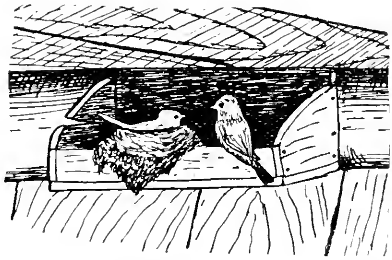


Fig. 21. — Phœbes' nest in box.

Barn Swallow. — Boxes or shelves similar to those used by phœbes may be placed in barns for the barn swallows, but a little block nailed on a rafter is all they need, or a lath nailed across two rafters so that the ends project. (See Plate VI.) Even two nails driven into a beam or rafter about 2 inches apart, the heads projecting about 2 inches, may be utilized, and will be support enough to keep the nests from falling. When rafters were made of knotty logs or mere poles with the bark removed no such supports were needed, but sawed timbers do not present safe points of attachment for mud-built nests. There should be an opening in every barn for swallows to enter.

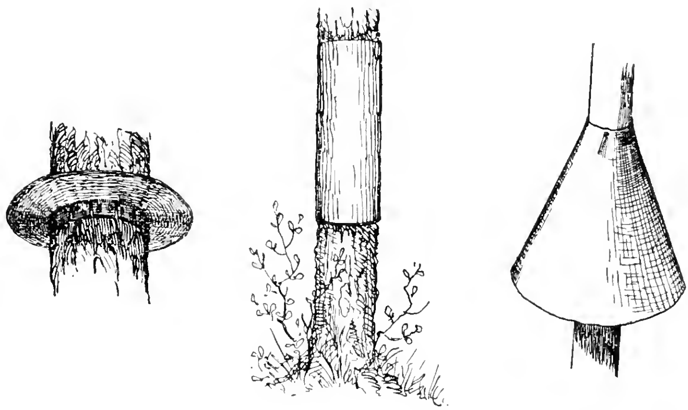
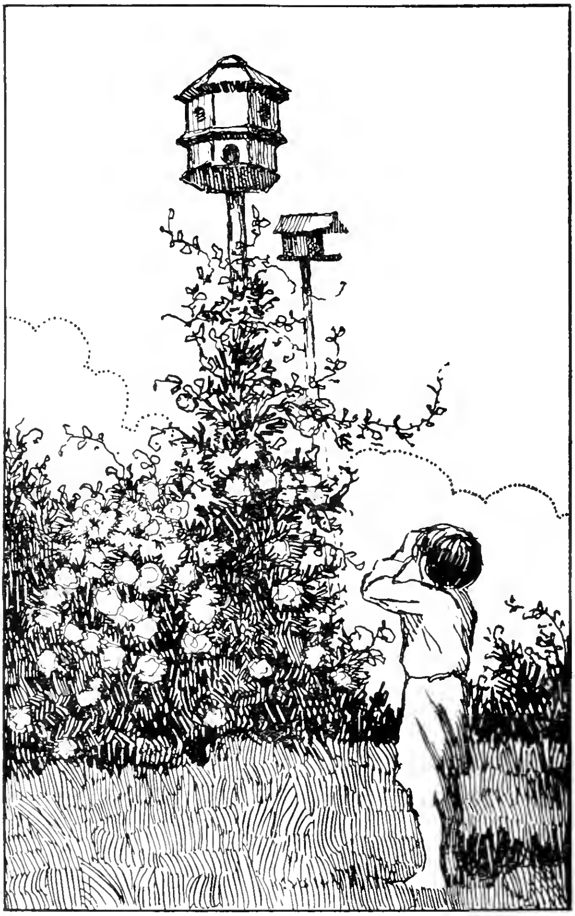


Fig. 22. — Devices to keep cats, squirrels, etc., from climbing to bird houses.

Cliff or Eaves Swallows. — These require wide eaves and a strip of board or small timber nailed a foot below the junction of the side and roof of the building. Mud does not stick well to paint, hence the need of a supporting ledge.

Experience with nesting boxes on trees, particularly in woods, has proved that they are occupied mainly by squirrels and mice or remain unused. These animals, as well as cats and



A Dorothy Perkins rose bush. Grown on a bird-house pole for ornamentation and protection against cats. (After Our Dumb Animals.)

sometimes rats, drive the birds out and destroy their eggs and young (see Plate V.). Nests on poles are not so often visited by the foregoing enemies of birds, and such nests may be protected against them by any one of the devices shown (Fig. 22). Nests on isolated trees may be safeguarded in a similar

PLATE VII.

Fig. 1. — A colony. Three nesting boxes on one tree, all occupied by birds, on the reservation of the Massachusetts Commission on Fisheries and Game at Martha's Vineyard. (Original photograph.)

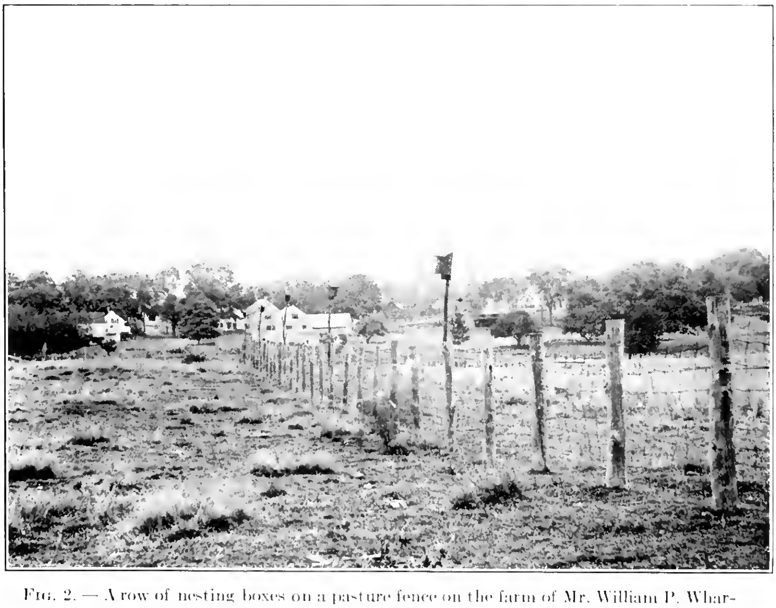


Fig. 2. — A row of nesting boxes on a pasture fence on the farm of Mr. William P. Wharton, Groton, Massachusetts. This plan is successful. A large proportion of these boxes were occupied. (Original photograph.)

manner, but in the woods protection is hopeless, and hole-nesting birds, with the exception of chickadees, will rarely

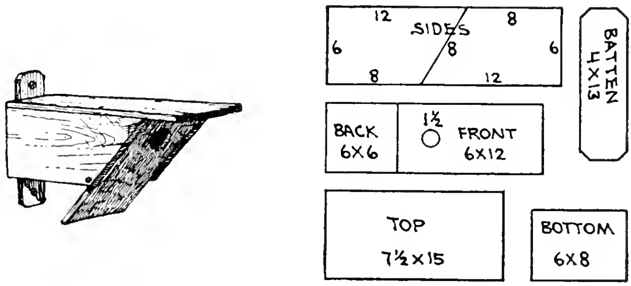


FIG. 23.—Swallow box, supposed to be cat-proof, and details of construction.

nest there. Boxes placed on poles set up in a pond or on a small island bring good results.

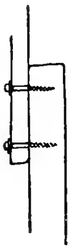


FIG. 24.

Poles need not be more than 6 or 8 feet in length, except for martins, and may be very slim, made from a young pine or cedar or any other sapling. They may be screwed to fence posts with lag screws (large screws with square heads; see Fig. 24 and Plate VII., Fig. 2) so that they may be taken down in the fall and stored away until spring. Where there are no fences, posts may be set in the ground and the poles fastened to them. Boxes put up on the walls or ridgepoles of buildings often attract birds if the trees are not near enough to allow squirrels to reach them, and if cats cannot get at them. (See Plate VIII.)

HOW TO ATTRACT THE BIRDS.

If nesting boxes are set up in accordance with the foregoing directions, English sparrows disposed of, and nests safeguarded against cats and squirrels, some of the boxes are sure to be occupied by birds, provided there is a sufficient diversity of vegetation in the neighborhood to furnish them with a variety of insect food and wild fruit, and unless they are too much disturbed by the noisy activity of their human, feline or canine neighbors. We cannot expect many birds to be attracted to a city yard where there is neither grass, trees, water nor shrubbery. They always appreciate a near supply of water. If nesting material such as hay, straw, twine, cotton, hair, string, etc., be hung on a fence or placed on a bushy branch near the nesting box, that alone may decide some bird to nest there. If twine is put out it should be cut in short pieces not over a foot in length, else birds may be ensnared by it. Wherever a pair of tree swallows nest, many other boxes, similar to the one chosen by them, should be put up on poles, for they are sociable birds and one pair will attract others.

Experiments sometimes have demonstrated that certain individual birds are grateful for nesting material placed in the box. A pair of chickadees made their nest by digging a hollow in cotton batting that I had placed in the bottom of the box for their use. It is well always to keep a few nesting boxes out all winter with some cotton or other nesting material in the bottom of each, to furnish winter lodging for chickadees, nuthatches and woodpeckers, as these birds like to sleep in such snug quarters. Chickadees and nuthatches may be attracted to nesting boxes by first destroying all the decayed trees and stumps near by, and then feeding the birds all winter on bits of suet, meat, fat or sunflower seeds placed near the boxes. If this supply is kept up during the spring, some of the birds are likely to nest in the boxes and their young seek similar domiciles until a little colony becomes established.

Wrens are rare and local in Massachusetts, but when once a colony is started they are almost perfectly protected in nesting boxes and are likely to increase. There should be at least three boxes to each pair of wrens, as they are so industrious that a pair often will build two additional nests beside the one in use, and such building activity may keep them out of mischief. Otherwise they may attack the eggs of other birds.

Many writers express the belief that it is a mistake to put up nesting boxes too near together, as jealousy and fighting will ensue and none of them will be occupied. I have held this view and published it, but have discarded it since I have seen five pairs of bluebirds nesting in the trees around one farm house; three pairs of tree swallows nesting in boxes on one small tree; several pairs of bluebirds in boxes on one barn, and a pair of bluebirds and one of tree swallows on one pole. (See Plate VII., Fig. 1, and Plate VIII.)

PLATE VIII.

An example of a bird colony on a building. Nesting boxes on one of the farm buildings of Mr. Geo. E. Hoxsie of Canonchet, Rhode Island. Every building on his place has nesting boxes. In 1912, forty-three nesting boxes were taken by tree swallows and bluebirds. There were thirty-two nests of eaves swallows and eighteen of barn swallows.

Other things being equal, the more boxes the more birds. But the house wren may be an exception to this rule, as it sometimes is exceedingly quarrelsome. My later experience seems to show that a plethora of boxes makes less trouble than is the case where few are available. Ordinarily, boxes set up 100 to 200 feet apart are more likely to be occupied the first year than those situated closer. Later, if these are successful, the number may be increased.

Bird Houses.

The purple martin is the only bird that needs a bird house. It is a waste of lumber to build houses with many rooms for any other bird, as a single pair of bluebirds, swallows or wrens will hold a large, expensive house against all comers except the English sparrow or the starling. The martin is a large, handsome swallow with pleasant, cheerful notes, and is very destructive to insect pests. Martins formerly were abundant locally in Massachusetts, but after the introduction of the English sparrow the number of martins and the localities frequented by them diminished rapidly until 1904, when cold June storms nearly exterminated the species in Massachusetts. Since then their numbers have increased very slowly, as

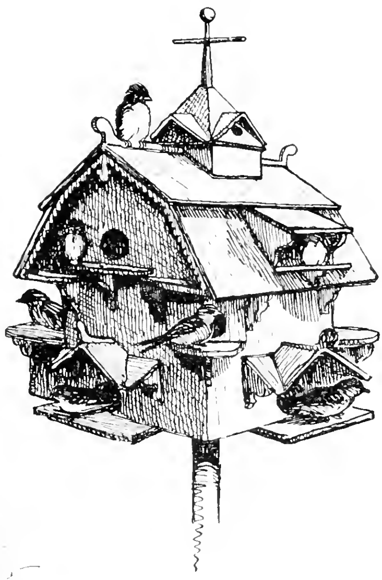


Fig. 25. — Martin house, after Trafton. (Courtesy Houghton Mifflin.)

Fig. 26. — Martin house.

few people now put up martin houses, and English sparrows or other birds keep the martins from settling in some of those that have been erected. Martins, unlike most native hole-nesting birds, prefer to nest in large colonies. Hence martin houses usually are made with many compartments. The Indians hung many hollowed gourds for the martins on the poles of their wigwams or on some dead tree near by. Some of the southern people still use gourds to attract martins. Often several gourds are hung from a crosspiece on a tall pole (Fig. 27), and these collections of gourds are popular with the martins. Only the larger gourds should be used for them. If a round entrance hole is made it should be about $2\frac{1}{2}$ inches in diameter, as the martin likes to have the entrance large enough to admit the light as he enters.

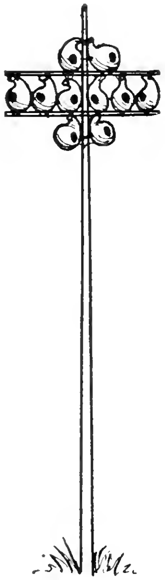


Fig. 27. — Gourds for martins.

Poles for martins should be at least 10 or 12 feet high. Such poles are sufficient if placed in quiet places, not too near trees or dwellings, or where noisy, quick-moving children or dogs are at play; but if there is much noise and disturbance, a pole 20 feet or more in height may be necessary. No pole is likely to be too high for martins. They seem to prefer a height of 20 or 30 feet. These birds frequently have nested in quiet places among trees and quite near houses, even in nesting boxes on poles on the roofs of wooden buildings or high city blocks, but they will not accept hidden nesting places where they have to fly in among the branches of leafy trees, and they seem to come most readily to a bird house situated in an open yard or on a wide lawn. They seem to prefer low ground to high ground, and always like the neighborhood of water. Therefore an open river valley suits them, but people not having these advantages need not despair, as martins often have nested on high ground, but rarely, I believe, far from water. A good drinking and

Fig. 28. —Martin barrel.

bathing fountain with running water might help to induce them to settle where other water is absent. A good martin box may be made of any strong barrel (Fig. 28), and I have seen such boxes occupied for many years by these birds. The bottom of each entrance hole may be level with the floor of its compartment, to facilitate cleaning out and to allow any water that may drive in to run out again, but it is well to have a gallery or veranda under the upper openings and overhanging the lower. This and the projecting eaves should shed most of the rain.

Fig. 29. — Successful soap box martin colony of three houses.

The entrance holes may be made $2\frac{1}{4}$ inches in diameter if square, or $2\frac{1}{2}$ inches if round.

Mr. J. Warren Jacobs of Waynesburg, Pennsylvania, who probably has had more experience in building martin houses than any one else now living, recommends making each apartment 6 inches square and 7 inches high. Any box about this size may be used for the apartments, and all may be backed by a square box running up the center of the barrel into which a square pole will fit. The barrel may be attached to the pole by two angle irons and roofed with zinc. Every martin house should be well painted outside but not inside, with two or three coats of good white or light-colored paint. Dark-colored houses are very hot in sunny weather. Care is taken not to let the paint run into the entrances, and to paint only up to the edge of each.

Mr. Arthur W. Brockway of Hadlyme, Connecticut, has established a large colony of martins by building small cottages out of grocery boxes. (See Fig. 29.)

Mr. Jacobs asserts that a martin house should have only entrance ventilation, but Mr. Dodson of Chicago makes the attic of his martin house so that it may be entered from either end, and claims that the martins invariably occupy these upper rooms first. I have noted that when cold storms destroy young martins, those on the sides of the house, exposed to the cold winds, die first.

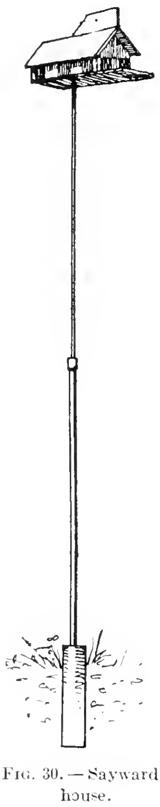


FIG. 30.—Sayward house.

Mr. William A. Sayward of Allston, Massachusetts, has invented an ingenious device to turn the openings of the house away from strong winds and rain. (Figs. 30, 31 and 32.)

He takes a piece of $1\frac{1}{4}$ inch iron pipe, 7 feet long, and sets it into a cylindrical piece of cement, made by filling with cement a funnel or stove pipe 7 inches in diameter and 30 inches in length. This cement is set into the earth so that the top of the cement is level with the surface of the earth. At the top of the 7-foot pipe a reducing coupling is put on, and another piece of inch pipe about 8 feet in length is added. Upon this a bird house of two compartments is mounted. The floor dimensions are 11 by 16 inches inside. The construction is illustrated in Figs. 30, 31 and 32. A block is driven inside the top of the pipe and a slide caster is fastened to the top of the block. Another one, inverted, is driven into a block in the top of the house, so that the whole house easily revolves on the two slide casters.

Poles may be made of wood or metal A two-inch galvanized or painted iron pipe will hold a small martin house and will be cat proof and snake proof, but rats or squirrels might climb it. Nevertheless, if the house is large enough they cannot go beyond the floor unless brackets, which should never be used, are provided for them to climb. Sometimes martin houses are mounted on dead trees. Smooth poles are believed to be snake proof. Trees with bark on are not. Cats sometimes quickly climb wooden poles and catch martins by reaching past the lower edge of the house.

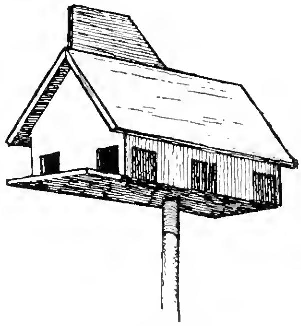


Fig. 31.—Sayward weathercock house.

Mr. Jacobs uses a hinged pole for mounting his larger bird houses, so that they may be taken down easily and cleaned out and housed during winter.

It would facilitate the handling and cleaning out of martin houses if a door opening to the full width of each compartment could be provided, and then, if bluebirds or tree swallows persisted in occupying it, their nests and eggs or young

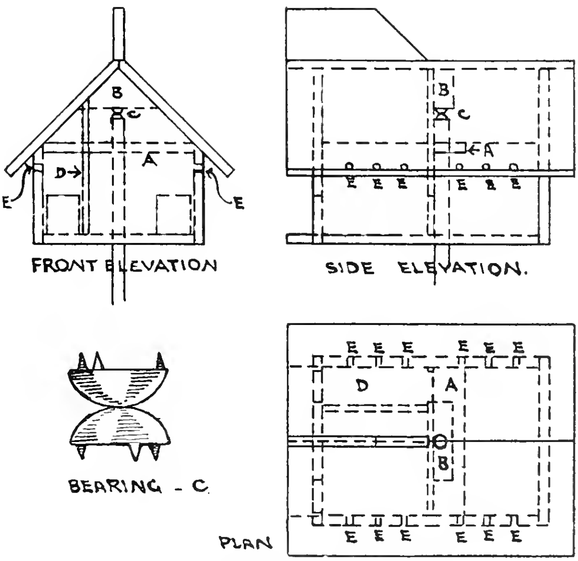


Fig. 32.—Details of Sayward house.

could be removed to single boxes, which should be in readiness in the vicinity.

How to get the Martins.

The bird house must be erected in a conspicuous place and the English sparrows and starlings kept out. This may be accomplished by the use of a shotgun,[1] or the entrances may be kept closed until the martins come, when a few may be opened and the martins may be able to beat off the sparrows, but if even one pair of sparrows becomes established in that house, and is allowed to breed, the martins are doomed to eviction sooner or later. They may hold on for a few years, but the sparrows will possess the house in the end. I have never known them to fail. If the martins persist, the sparrows break the eggs or kill the young.

Screech owls and cats must be watched. Cats catch the male martins when, in fighting, they come to the ground, take both parents when they alight on the ground for nesting material, and kill many young ones before they are able to fly well. The owls sometimes get the habit of reaching in at night and pulling out young birds. The martins will drive all hawks away.

The English Sparrow.

The European house sparrow is the greatest and most ubiquitous enemy of all native birds that nest in bird houses and nesting boxes. The United States Department of Agriculture, after a long and patient investigation that covered the greater part of North America, decided that it was "a curse of such virulence that it ought to be systematically attacked and destroyed."[2]

Von Berlepsch rates it as one of the few birds which must be destroyed at the Ornithological Experiment Station at Seebach.[3]

Although the sparrow, like most birds that live with man, is beneficial at times, most expert testimony is against it. In view of a multitude of requests for information regarding the means for destroying it, a bulletin on the subject is in preparation which will be issued by the Massachusetts State Board of Agriculture as Circular No. 48.

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[1] A long-barreled 22 caliber rifle, with extra long shells, smokeless powder and dust shot, is not noisy and ought to be effective at 40 or 50 feet.

[2] Barrows, W. B.: "The English sparrow in North America," U. S. Dept. Agr., Div. Ec. Ornith. and Mam. Bull. No. 1.

[3] Hiesmann, Martin: "How to attract and protect wild birds," translated by Emma S. Buckheim, 1912, p. 92.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 48.

August, 1915.

THE ENGLISH SPARROW AND THE MEANS OF CONTROLLING IT.

Edward Howe Forbush.

Revised and enlarged from the Fifty-ninth Annual Report of the Massachusetts State Board of Agriculture.

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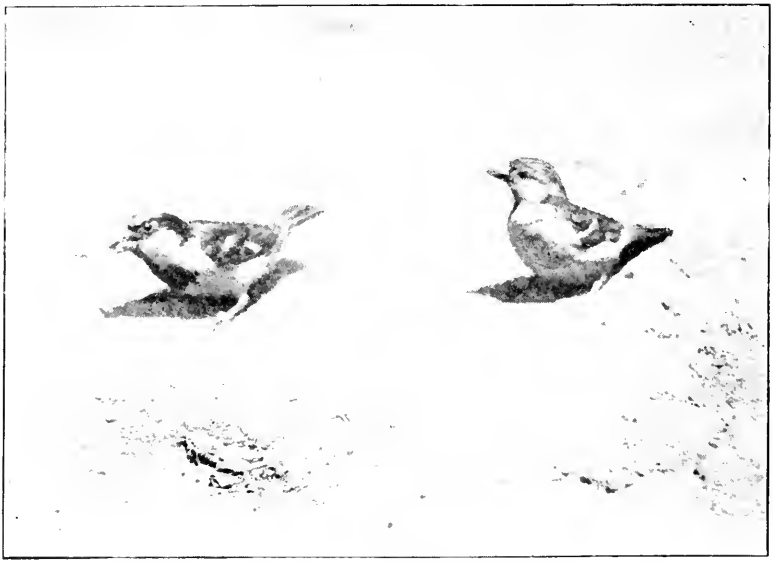
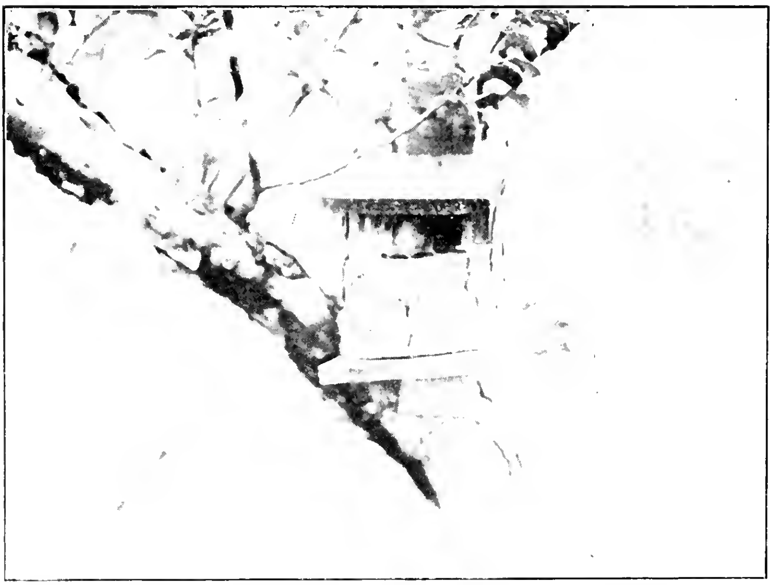


The house sparrow, or English sparrow (*Passer domesticus*), male and female.



Nesting box made for the English sparrow by Clayton E. Stone of Lunenberg, Massachusetts. Sparrows and starlings occupy these nesting boxes; bluebirds and swallows do not.

THE ENGLISH SPARROW AND THE MEANS OF CONTROLLING IT.

EDWARD HOWE FORBUSH, STATE ORNITHOLOGIST.

All our native sparrows are beneficial birds and should be protected. Care should be used not to disturb, molest or destroy any native sparrow or to confuse any with the imported sparrow which is the subject of this paper. The name English sparrow is a misnomer, as the bird referred to is the "house sparrow" (*Passer domesticus*) of Europe, where it is native to nearly the entire continent, but the former name has been adopted in the United States and will be perpetuated. The so-called English sparrow, regarded by practically all competent authorities as a pest in the United States, is more injurious and less beneficial than most native American birds, but nevertheless has many friends in this country. It has beneficial habits, for practically all land birds destroy pests of some kind. Few people may now remember that this sparrow on its introduction to America was recommended for the special purpose of ridding park trees of geometrid caterpillars, a service which it undoubtedly performs. Native birds, however, might have done as well or better had the sparrow been left in its original home, and had they been encouraged to nest in the parks, for practically all small birds eat such insects.

Many people have complained to me that the sparrow has driven other birds from nesting boxes and has dragged the young of other birds out of nests and killed them. Where there are English sparrows it is useless to put up nesting boxes or bird houses for native birds unless some effort is made to control this foreign enemy; otherwise the boxes eventually will be occupied by sparrows, other birds will be driven out and the net result will be an increased sparrow population. A great manufacturing firm writes: —

> The sparrows have become so numerous about our buildings as to be almost unbearable so far as noise is concerned. Also they are extremely dirty, and we are very desirous of keeping them away. It has occurred to us that poisoned food of some sort could be used with safety. May we not hear a word from you? If poison is proper, how shall we proceed?

Many inquiries similar to the above have been received. Most of these inquirers have been referred to Farmers' Bulletin 383, by Ned Dearborn, published by the Bureau of Biological Survey, United States Department of Agriculture, on "How to destroy English Sparrows," and Farmers' Bulletin 493, issued by the same Bureau, entitled, "The English Sparrow as a Pest," by the same author; but so many complaints continually come in and so many requests for methods of destroying the sparrow have been received, that at last it has become necessary in self-defense to publish a circular in reply to these complaints, giving the desired information.

The old-time question as to whether the sparrow is a pest or not continually comes up. The sparrow rears many young, and as the young are fed to some extent on insects they consume quantities of insects in a summer. Were the sparrows in our city parks destroyed, probably we should have serious trouble with certain leaf-eating insects before native birds could be attracted to these parks in any numbers, but few native birds can nest in the parks while the sparrow remains.

The greatest injury resulting from the introduction of the sparrow is the displacement of native birds and the consequent increase of injurious insects which the sparrow does not eat. The leopard moth, for example, which was introduced into this country in the latter part of the last century, has become very destructive where sparrows are most numerous. The control of this insect is difficult and expensive, as it is a borer, remaining most of the time within the wood. Apparently the sparrows do not disturb it, and where they are numerous and native birds are, therefore, scarce, this moth is very injurious, particularly in and around Boston, New York and other large cities. When the moth spreads out into the country, where woodpeckers and other native birds are numerous, it has, thus far, made no headway. Woodpeckers dig into the burrows where the larva hides, and other birds catch it when it leaves its burrow and crawls about on the bark. Had we kept out the sparrow and instead encouraged and attracted other birds into our cities we might have been spared the destruction of many shade trees by the leopard moth.

The sparrow, however, has many friends who seem to believe that it does only good and no harm whatever. To those who see only one side of the case the various publications on the sparrow are recommended, several volumes of which have been published. Chief among these is Bulletin No. 1 of the Division of Economic Ornithology and Mammalogy of the United States Department of Agriculture, by Walter B. Barrows, entitled the "English Sparrow in North America," a report of more than 400 pages. In this bulletin, which was regarded at the time as "the most important treatise ever published upon the economic relations of any bird," evidence regarding the habits and destructiveness of the sparrow was brought together from all parts of the United States and from Europe, Australia and New Zealand. The testimony against the sparrow from all these countries is overwhelming. Two other works devoted entirely to this species had been published previously in the United States, one in 1878 by T. G. Gentry, entitled "The House Sparrow at Home and Abroad," the other in 1879 by Dr. Elliot Coues, on "The Present Status of Passer domesticus in America, with Special Reference to the Western States and Territories." Since Bulletin No. 1, referred to above, was published other investigations of the sparrow have been made by scientists, and all have resulted unfavorably to the bird, notwithstanding the fact that it devours army worms, cotton boll weevils, brown-tail moths and other pests. Baron von Berlepsch, who has established the most successful European experiment station for the protection of birds, conserves practically all small land birds, but finds it necessary to destroy this sparrow in order to give the other birds a chance. The tremendous destruction to grain in the fields caused by this sparrow in grain-growing regions, its cost to poultrymen, its injuries to fruit and garden crops are well known. Where it has become numerous it has destroyed quantities of fruit, including grapes, cherries, strawberries, raspberries, currants, blackberries, peaches, apples, pears, plums, tomatoes, apricots and figs. Young plants, including peas, beans, cabbage, lettuce, radishes, corn and other vegetables, are torn to pieces or eaten to the ground. Garden seeds, including those of many vegetables and flowers, are scratched up when planted or eaten on the stalk. There is scarcely a garden fruit or vegetable which does not suffer more or less from the attacks of this bird. Buds and blossoms of numerous plants are destroyed by it.

Its filthy habits, which injure buildings, vegetation and clothing, constitute a minor annoyance, but its chief fault, as indicated above, is the molestation and destruction in the breeding season of harmless native birds of far more value to agriculture than itself. It is not necessary to repeat here the overwhelming testimony in regard to this that may be found in any of the three volumes hereinbefore cited. My own experience is convincing. During the last forty years I have seen it drive out the great flocks of snow buntings that once fed freely in city streets. I have seen it evict all species that nest in bird houses. Where it once gets a foothold in the bird houses it drives out all other bird tenants in the end. It destroys their nests, eggs and young, and it has been known to destroy wantonly the eggs, nests and young of many birds that do not nest in boxes. It appropriates the nests of swallows, robins, warblers and other birds, and has driven out swallows, martins and wrens from large areas. The cliff swallows or eaves swallows and house wrens formerly common in many parts of Massachusetts are rare now in a large part of the State, and this can be attributed directly to persecution by the sparrow. What has happened in Massachusetts has occurred over large sections in other States. In warmer regions than this, where the winters are not so severe as here, and the sparrows increase rapidly in numbers, the effect of their presence on native species is even more marked. Mr. Robert Ridgway, the eminent ornithologist of the Smithsonian Institution, has this to say of the sparrow in southern Illinois: —

The amazing increase of the so-called English sparrow has profoundly disturbed the "balance" of bird life. Although introduced less than forty years ago this species is now, without question, by far the most numerous bird in the region of which I write, even if it does not exceed in numbers *all* the native small passerine birds combined, not only in the towns but on the farms as well. The effect on native birds is exceedingly well marked, for the foreign pest has literally crowded out, or by its aggressive meddlesomeness driven away, from the abodes of man those charming and useful native birds, the bluebird, purple martin, barn swallow and cliff swallow. None of the native species likes its company, and, in winter, when one wishes to feed the cardinals, Juncos and other native birds, it is necessary to feed many times as many of those pernicious pests, thus vastly increasing both the trouble and the expense.

He gives details regarding the following species: —

Cliff Swallow (*Petrochelidon lunifrons*). — Formerly abundant, large colonies attaching their retort-shaped nests underneath overhanging eaves of barns, warehouses and other large buildings, but apparently has wholly disappeared.

Barn Swallow (*Hirundo erythrogastra*). — Almost totally expelled by the sparrow, great numbers of which have appropriated every nesting site in the barns and other outbuildings.

Purple Martin (*Progne subis*). — Mostly driven from towns and farms by the sparrow, the large trees containing cavities that are left being too few in number to accommodate more than a small percentage of the number that formerly occurred.

Bluebird (*Sialia sialis*). — This also has been mainly displaced by the sparrow, which has appropriated nearly all cavities suitable for nesting places.

Means of driving out Sparrows.

For the benefit of those who wish to control sparrows about their own homes some of the more common devices for ousting these birds are given below, some of which have been published in the excellent bulletins of the Biological Survey.

Many people wish to rid their premises of sparrows or to drive them out of bird houses, but not to kill them. It is practically impossible to drive them from any premises without continuous persecution, but they may be evicted from bird houses by systematic work without killing any. Various plans have been recommended, such as putting up nesting boxes without perches or with entrance holes in the bottom, providing a great plethora of nesting boxes or suspending them by wires. None of these expedients is of any permanent value except possibly the last, and that has not been uniformly successful. Mr. Clayton E. Stone of Lunenburg, Massachusetts, puts up in trees open boxes which seem to be rarely taken by native birds, except an occasional wren or a robin, but are accepted by sparrows and starlings. (See frontispiece.) These boxes may be worth a trial. Nevertheless, the sparrows do not confine themselves entirely to the open boxes, but now and then occupy a box intended for other birds. Where this happens the boxes intended for native birds may be so arranged that the sparrows may be kept out, entrapped or driven out. A box having an entrance not over seven-eighths of an inch in diameter will admit house wrens and keep out sparrows; chickadees have been known very rarely to nest in a box with a round entrance one inch in diameter, and this usually keeps out sparrows, but if the entrance is large enough for any bird larger than the house wren the sparrow may get in. As sparrows begin nesting earlier in the spring than most other birds they may be driven from a nesting box early in the year by removing the nesting material from the box several times a week. For this purpose a plethora of boxes must be used and each box must be easily accessible and must have an opening by means of which the nest may be taken out with little

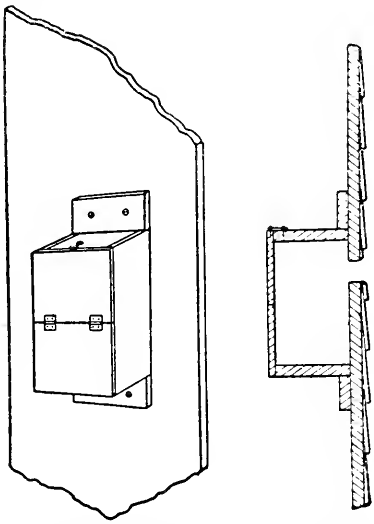


Fig. 1. — Perspective and sectional drawings of an improvised nest box for the interior of buildings. (After Biological Survey.)

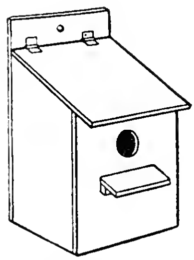


Fig. 2. — Nest box opening at the top. (After Biological Survey.)

trouble. Fig. 1 shows how such a box may be attached to the inner wall of a barn or other building, where it may be quickly opened from within the building and the nesting material removed; or boxes having hinged projecting covers which will shut out rain may be put up on poles or trees. (Fig. 2.) In my own experience success has followed the practice of removing the eggs from the nests at intervals of ten to fourteen days. A stream of water from the garden hose is very effective in evicting sparrows under some circumstances. If used on cold or frosty nights, after the sparrows have retired, it will drive them from their nests or roosting places in bird houses, or on vine-clad walls, where they constitute a nuisance. If one application is not enough it may be repeated at intervals of a few days. In wet weather, when fireworks can be used with safety, small Roman candles are recommended as an effective form of night bombardment. Sparrows do not appreciate fireworks. If some of the sparrows are killed or captured when they are disturbed this persecution will have a more permanent effect.

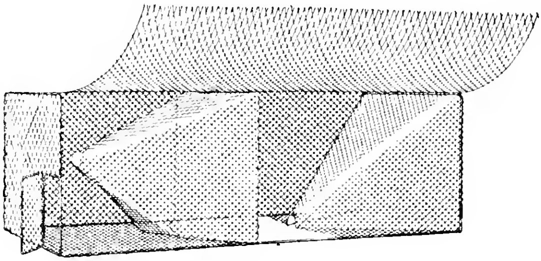


Fig. 3. — Funnel trap. Side raised to show interior. (After Biological Survey.)

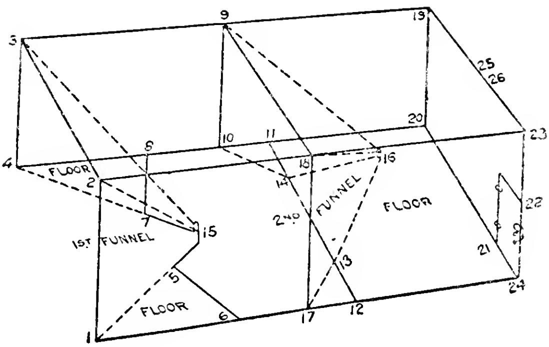


Fig. 4. — Outline of funnel trap. (After Biological Survey.)

Trapping Sparrows.

There are many contrivances for catching sparrows on the nest, some of which are given in the bulletins of the Biological Survey hereinbefore cited, but a deep hoop net on the end of a pole may be used to catch them by placing it over the entrance of the nesting box and driving the sparrow into it.

There are successful devices for trapping sparrows also, which are illustrated in Farmers' Bulletins 383 and 493. One of the simplest of these is the wire funnel trap perfected by Dr. A. K. Fisher of the Biological Survey. Fig. 3. shows the trap and

Figs. 4, 5 and 6 give details of construction. This trap is easy to make and the cost of material is small. It has been tested on the agricultural grounds at Washington and also in the Missouri Botanical Gardens at St. Louis, and has caught hundreds of sparrows in a few weeks.

The following directions for making this trap are taken from Farmers' Bulletin 493: —

The essential parts of this trap are: (1) a half funnel leading into (2) an antechamber, which ends in (3) a complete funnel leading into

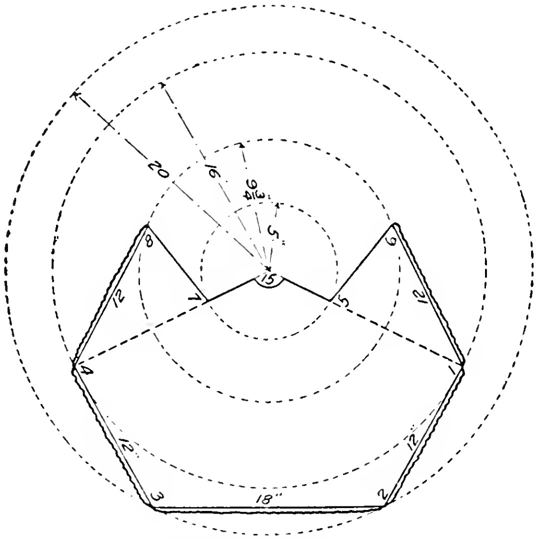


Fig. 5. — Pattern for first funnel of a trap to be 36 by 18 by 12 inches. (After Biological Survey.)

(4) a final chamber. It is made of woven wire poultry netting of three-fourths inch mesh, and is re-enforced around the open end and along the sides at the bottom by No. 8 or No. 10 wire, which is used also around the aperture for the door and around the door itself. The angles between the first funnel and the walls of the antechamber are floored with netting and the final chamber is floored with the same material. The accompanying drawings will enable anybody handy with tools to construct one of these traps in a few hours. These plans are for a trap 3 feet long, a foot and a half wide, and a foot high. At ordinary retail prices the cost of material will be about 70 cents. Paper patterns for the two funnels can be made by first drawing the concentric circles, as shown in Figs. 5 and 6, and then laying off the straight lines, beginning with the longest. The wavy outlines indicate that the pattern is to be cut half an inch outside of the straight lines to allow extra wire for fastening the cones to

the top and sides of the trap. Fig. 7 shows how all the parts of a trap having the above dimensions may be cut from a piece of netting 4 feet wide and 6 feet long. The full lines in this figure indicate where the netting is to be cut and the broken lines where it is to be bent. The numbers at the angles in Figs. 5, 6 and 7 correspond with those in Fig. 4, which shows in outline the relation of the different parts as they appear when assembled. A trap of the above dimensions is as small as can be used satisfactorily. Where sparrows are very numerous a larger size is recommended. Fig. 8 shows how a trap 4 feet long, 2 feet wide, and 15 inches high may be made from a piece of netting 4 by 10 feet. This is a very good size for parks and large private grounds.

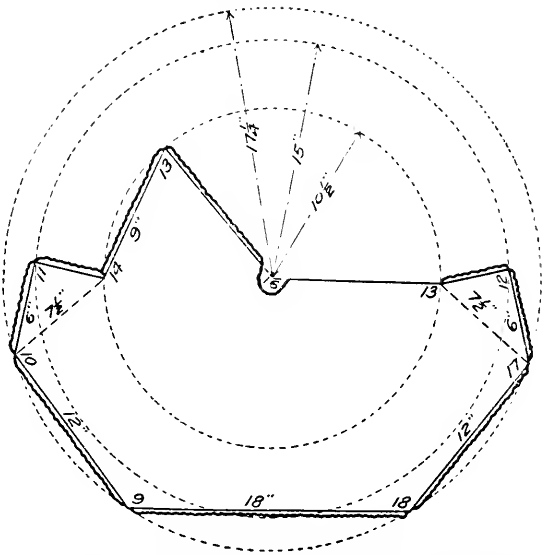


FIG. 6. — Pattern for second funnel of a trap to be 36 by 18 by 12 inches. (After Biological Survey.)

In setting a funnel trap a place should be selected where sparrows are accustomed to assemble. Often there are several such places in a neighborhood, in which case it is advisable to move the trap daily from one of them to another, because the birds appear to associate the locality rather than the trap with the distress of their imprisoned comrades. Canary seed, hemp seed, wheat, oats and bread crumbs are excellent baits. The bait should be scattered in the antechamber and first funnel, and also, sparingly, outside about the entrance. A live sparrow kept in the trap as a decoy will facilitate a catch. In case native birds enter a trap they may be released without harm. Trapping may begin at any time after young sparrows are able to take care of themselves, which is usually by July 1. Each day's catch should be removed from the trap at nightfall, and if a decoy is used it should be comfortably housed and otherwise cared for when off duty.

In removing sparrows from either a funnel or a sieve trap the receiving box shown (Fig. 9) will be found useful. It should be about 6 inches square and 18 inches long, inside measurement. The door, hinged at the bottom and turning inward, is controlled by the part of its wire frame extending through the side of the box to form a handle. The box as it appears in the figure is ready to be placed before the open door of a trap from which birds are to be driven.[1]

Mr. Charles W. Miller, formerly director of the Worthington Society for the Study of Bird Life, has perfected an excellent trap for sparrows which has been very successful, but as its

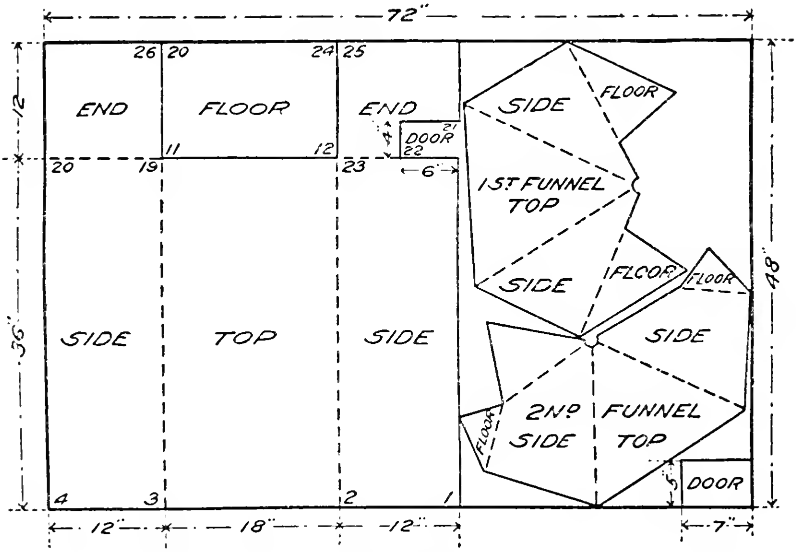


Fig. 7. — Diagram for cutting out the parts of a funnel trap 36 by 18 by 12 inches. (After Biological Survey.)

construction is more complicated and its manufacture more expensive than that of the funnel trap, those who desire to try it are referred to Farmers' Bulletin 493, in which it is illustrated and described.

Sparrows are so wary that it may be difficult to entrap them. Traps have given best results in Massachusetts in winter, after storms, when snow covers much of the natural food of the sparrow. It is not to be expected that trapping will succeed if the sparrows can get all the food they need in some near-by poultry house or stable yard. Some poultrymen who keep

[1] Dearborn, Ned, The English Sparrow as a Pest, U. S. Dept. of Agr., Farmers' Bulletin 493, 1912, pp. 17–20.

grain constantly before the fowls probably feed nearly as much to rats and sparrows as to fowls. Poultry should be fed indoors; every poultry house should be rat proof, and all openings should be covered with cellar wire netting which will keep out rats, mice and sparrows and save the poultryman more than

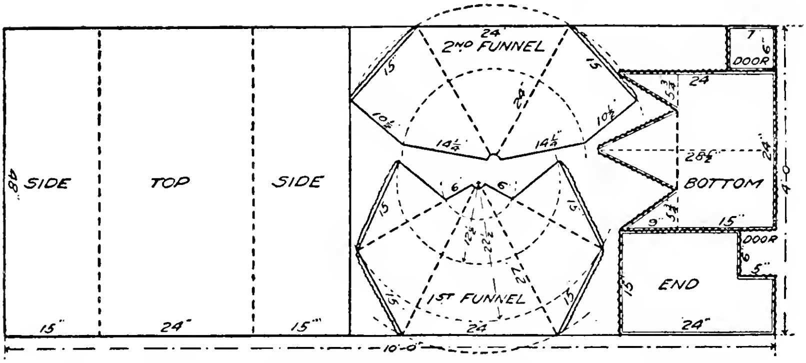


FIG. 8. — Diagram for cutting out the parts of a funnel trap 48 by 24 by 15 inches. (After Biological Survey.)

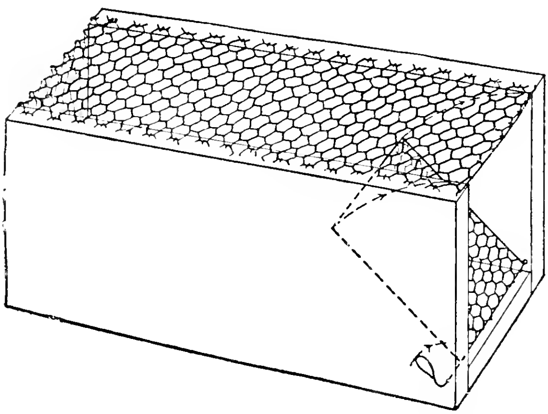


FIG. 9. — Receiving box for removing sparrows from trap. (After Biological Survey.)

its cost in a single year. Where poultry foods are thus protected sparrows may be caught with ease. Any poultryman may catch large numbers of sparrows in winter by closing all but one opening in a henhouse and enticing the birds in by means of grain. After they have been well fed in this building for a week or two, and have become accustomed to feed there in numbers, the opening may be closed from a distance by means of a cord attached to a shutter or sash or to its support, and the sparrows may be imprisoned and killed. Another plan is to imprison them in the afternoon and let them out in the morning until they have become accustomed to roost in the building in large numbers, when they may be readily despatched at night. Mr. Wilfrid Wheeler, secretary of the Massachusetts State Board of Agriculture, reports success with this plan.

Poisoning.

The use of poison generally cannot be recommended, but when used with great care it has given excellent results. Successful methods are given below.

The following formula and directions for poisoning English sparrows are given by Ned Dearborn of the Biological Survey, United States Department of Agriculture: —

> Where the use of poison is not prohibited by law it may be employed effectively to reduce the number of sparrows. Of the different poisons tested the most satisfactory is strychnine, which is easy to prepare and acts quickly. Wheat has proved to be a good bait as well as an excellent vehicle for administering the drug. A convenient method of preparing poisoned bait is as follows: put one-eighth ounce of pulverized strychnine into three-fourths of a gill of hot water, add $1\frac{1}{2}$ teaspoonfuls of starch or wheat flour moistened with a few drops of cold water, and heat, stirring constantly till the mixture thickens. Pour the hot poisoned starch over 1 quart of wheat and stir until every kernel is coated. Small-kerneled wheat sold as poultry food, if reasonably clean, is preferable to first-quality grain, being cheaper and more easily eaten by the sparrows. A 2-quart glass fruit jar is a good vessel to mix in, as it is easily shaken and allows the condition of the contents to be seen. If the coated wheat be spread thinly on a hard, flat surface it will be dry enough for use in a short time. It should be dried thoroughly if it is to be put into jars and kept for future use. Dishes employed in preparing poison may be safely cleansed by washing.
>
> Other seeds, as oats, hemp or canary seed, may be used instead of wheat in the above formula, but they are less economical because much of the poison is lost when they are hulled, though enough of it usually sticks to the mouths of the sparrows to produce fatal effects. As wheat has no hull that a sparrow can remove, it is ordinarily preferable to other seeds. Bread, in thin slices, spread with the strychnine-starch mixture may be used to advantage alternately with seeds.
>
> In case it is impracticable to poison sparrows at their regular feeding grounds they may be attracted to a suitable place by preliminary baiting. In northern latitudes the best time to put out poison is just after a snowstorm, when other food is covered. The feeding place should be cleared

of snow and the poison laid early in the morning. The poison should be well scattered, so that many birds may be able to partake at the same time, since after a few are affected their actions excite the suspicion of their comrades. Usually a few sparrows get only enough strychnine to paralyze them for a few hours, after which they recover. It is important, therefore, to visit the feeding places a short time after distributing poison to prevent such birds from escaping. It is well, also, to remove dead birds promptly to avoid exciting the suspicions of those that are unaffected. In deciding the amount of poisoned wheat to put out at one time, it is well to estimate the number of sparrows frequenting a feeding place, and to allow about 20 kernels for each sparrow. Although 2 kernels of wheat coated with the solution described below have been known to kill a sparrow, 6 or 7 kernels are required to insure fatal results, and much more than a fatal dose is frequently taken. The sparrows that recover after taking poison or that become frightened by the death of comrades, will forsake a feeding place if poison is kept there constantly. If, therefore, one wishes merely to keep them off his land he can do so by maintaining a supply of poisoned bait for them. On the other hand, if extermination is the object sought, unpoisoned bait should be put out after each killing until the birds have recovered confidence. There is an advantage in having several feeding grounds that may be used in rotation with different kinds of bait. Under these circumstances the sparrows forget their fear of each feeding ground while the others in turn are baited. Only as much poison should be put out as is likely to be eaten in one day, since exposure to moisture reduces its virulence. Any grain coated by the above process and left on the ground will become harmless after a few rains.[1]

During several years Dr. C. F. Hodge, formerly of Clark University, Worcester, organized a very effective campaign in Worcester for destroying English sparrows. His poison formula is as follows: Dissolve one-eighth of an ounce of powdered strychnine sulphate in one-half pint of boiling water. He gives the following directions for using his formula: —

Pour this, while hot, over two quarts of wheat (or cracked corn), stir well, and continue stirring from time to time, until all the liquid is absorbed. Dry thoroughly, without scorching, and put away in some safe receptacle, labeled "Poisoned Grain. Strychnine". . . . Expose the grain where poultry and tame pigeons cannot get it, and by operating only during the winter there will be no danger of poisoning seed-eating wild birds, at least for all northern towns and cities. By taking advantage of the sparrows' gregarious habits, and the fact that they drive off other birds from localities where they are numerous, much might be done even in the south.

[1] Dearborn, Ned, The English Sparrow as a Pest, U. S. Dept. of Agr., Farmers' Bulletin 493, 1912, pp. 20-23.

Sparrows are such suspicious and cunning birds that, if the strychnized grain be exposed at first, they will probably roll each kernel in their bills, taste it, reject it, and possibly refuse to touch it again that winter. The best way is to select a safe place, where the wind is not likely to scatter it, — a walk, driveway or porch roof with a smooth surface, — so that the grain may be swept up after each trial. Accustom them to feeding there daily with grain exactly like that which is medicated (I often do this for a week or even a month, until all the sparrows in the neighborhood are wont to come regularly), study the times when they come for their meals, and then on a cold, dry morning after a heavy snowstorm, having swept up all the good grain the night before, wait until they have gathered, and then put down enough strychnized grain to feed the entire flock. You have about ten minutes before any begin to drop, and those that have not partaken of the grain by this time will probably be frightened off; but, by timing it properly, I have repeatedly caught every sparrow in the flock. I have found morning the best time, as they all come then; and it is essential to success to select a dry day, since in wet weather they taste the strychnine too quickly; I have seen them actually throw it out of the crop.[1]

Shooting.

For ten years my farm was kept clear of sparrows by the practice of shooting promptly the first one that appeared. They never got a foothold, never nested there, and did practically no harm, although they were domiciled on the premises of my neighbors where they drove out a large colony of cliff swallows and all the bluebirds, tree swallows and martins. Shooting is very effective if the sparrows are greeted with a charge of shot or a bullet every time they appear, and they soon learn to fly high where they get such a greeting. A skillful rifleman may pick off individual sparrows with a good air gun or a Flobert or other small 22 caliber rifle as they come to feed or to the nesting box, but most people have better success with a small shotgun and number 12 shot. If smokeless powder and small-bore weapons are used the noise of an occasional shot will not disturb native birds, and in some cases they seem to be gratified by the destruction of their garrulous, pugnacious enemy. Where sparrows are numerous a good plan is to scatter grain in a long line at a certain hour each day, and when the sparrows of the neighborhood have learned to gather promptly at the appointed hour the shooter who has concealed himself for the purpose shoots down the line. Thus nearly

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[1] Hodge, Clifton F., Nature Study and Life, 1902, pp. 315-316.

every bird may be killed at one discharge of the gun. If the sparrows frequent poultry houses where there is danger of shooting fowls the bait may be placed on a long narrow board above the fowls' heads. Persistence in the use of such methods as those detailed above will tend to make any premises so unsafe for sparrows that they will prefer to reside elsewhere.

Co-operation in Sparrow Killing.

In many parts of Europe, where a constant warfare is waged against this bird, clubs are formed for the purpose of killing sparrows. In some cases each member of such a club is bound to present to the secretary the heads of a certain number of sparrows each year or to pay a fine. The fines thus collected are used as prizes for the members killing the most sparrows. The honorary secretary of the Stratford-upon-Avon Sparrow Club reported that during the year 1887 over 19,000 birds had been killed. About 20,000 a year is the average number destroyed in the neighborhood of Stratford-upon-Avon.

Similar clubs have been formed in some parts of the United States. In one sparrow hunt in Woodworth, Ohio, 26 men killed 980 sparrows.[1]

Bounties.

The theory that a bounty should be offered to encourage the extermination of the English sparrow has had many friends, but where this plan has been tried it has not given satisfactory results.

Dr. Barrows, in his report on the English sparrow, makes an estimate of the cost of exterminating sparrows by bounty in the State of Ohio. The sum required exceeds $11,000,000. Michigan and some other States have tried the plan of exterminating sparrows by bounty, with very unsatisfactory results. Notwithstanding the payment of considerable sums of money, the number of sparrows did not seem to decrease; also, it was found that birds of many species, most of them useful native birds, were killed as sparrows by hunters for the bounty, and in very many cases bounties were paid on their heads. A reward offered for the destruction of English sparrows would be certain to bring about the death of numberless native birds.

[1] Barrows, Walter B., Bull. 1, U. S. Dept. of Agr., Division of Economic Ornithology and Mammalogy, The English Sparrow in North America, p. 166.

Protecting Grain, Fruit and Vegetables.

Where sparrows are numerous and become destructive to growing grain, shooting in spring, summer and autumn, and poisoning in winter are the only remedies known. When the grain is ripening the crop may be protected by boys armed with guns and kept constantly in the field from dawn to dark. Powder may be used mainly to frighten the birds, and a charge of shot may be sent after them occasionally when they cease to fear blank cartridges. Large clappers made of boards to imitate the sound of a gun are used in England and might be utilized here a part of the time to drive away the birds and save powder. Similar means may be used to save fruit. If the fruit plot is small it may be covered during the ripening season with a fine-meshed fish net. A few cherry trees are sometimes protected in this manner. Young plants, such as peas, cabbages, etc., have been saved from the sparrow by covering the rows with small branches.

To prevent Sparrows taking Food designed for Native Birds.

Many people have complained that where seed, suet and other food have been put out for winter birds on feeding tables or shelves sparrows have taken all or nearly all the food. Sparrows do not like swinging shelves which may be hung by wire, or better yet by spiral springs, which make them still more unstable. Native birds use such shelves. Where sparrows eat suet it may be crowded into auger holes bored in sticks, and the sticks may be fastened to the under side of a limb where woodpeckers, nuthatches and chickadees will easily get at the suet. Sparrows seldom will take the trouble to cling to the underside of a limb.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

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FOOD PLANTS TO ATTRACT BIRDS AND PROTECT FRUIT.

EDWARD HOWE FORBUSH.

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ORNAMENTAL AND OTHER FOOD PLANTS USED TO ATTRACT BIRDS AND PROTECT CULTIVATED FRUIT.

Introduction.

The Arnold Arboretum at Boston has become noted as a resort for birds. Probably the number and variety found there are not exceeded in any upland locality in New England. Any observing person frequenting the Arboretum can see for himself that birds are attracted there by the diversity of plants, which support a great variety of insects and produce quantities of fruit and seeds, thus affording birds an unusual abundance and variety of animal and vegetable food.

It would be well for the farmer and the orchardist to make their home grounds especially attractive to useful birds. And all who live in the country or in the suburbs, and even some who reside in cities, may, if they will, utilize plants to attract birds. Landscape architects and gardeners who lay out the grounds of large estates often plant quantities of shrubs and trees without considering what are inviting to birds. While there are many flowering plants that birds like, there are many also that bear highly colored and ornamental fruit on which birds feed. Nearly all of these plants can be utilized in beautifying country estates. There should be fruit-bearing shrubbery and vines and dense hedges or tangles of ornamental fruiting plants. The coniferous trees may be best used in small patches or rows as windbreaks, for large groves of such trees are likely to shelter hawks, crows, squirrels and other enemies of birds.

The up-to-date fruit grower should never plant an orchard or attempt to cultivate small fruit without first providing rows of early wild fruit to attract the birds from his cultivated varieties. Otherwise, unless there is a quantity of wild fruit growing in the neighborhood, birds are likely to reduce his profits.

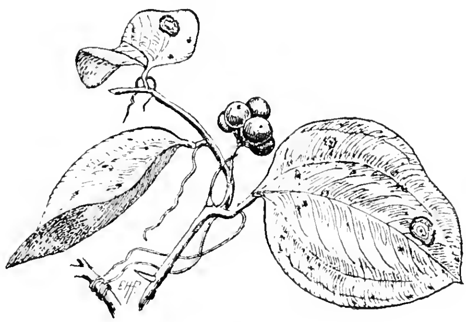
Plants Attractive to Fruit-eating Birds.

Farmers know that birds are fond of the earliest cherries and strawberries, and that some will feed on raspberries and blackberries unless there is other more attractive food near. Therefore, if fruit is wanted only for home use it is well to plant enough for the family and the birds. If cultivated small fruits are planted in quantity, all the fruit-eating birds of the neighborhood will be there when the fruit is ripening. But there are other fruits even more attractive to birds. First among these for early summer are the wild strawberry (*Fragaria americana*), the June berry or service berry (*Amelanchier canadensis*), the red-berried elder (*Sambucus racemosa*) and the white mulberry (*Morus alba*). The wild strawberry fruits as early as the cultivated varieties, and it lasts longer. The June berry is earlier than the earliest cherries, and is supposed to hang later, but in my experience the birds get all the June berries before July 4, and if gray squirrels are very numerous they are likely to take the fruit even before it becomes ripe enough for the birds. This is a fine fruit to cultivate could the birds be kept away from it. The red-berried elder fruits early in June, and like the common elder (*Sambucus canadensis*), which fruits in Massachusetts in August and September, is one of the chief attractions for summer birds. All the mulberry trees are extremely inviting to birds. The native red mulberry (*Morus rubra*) is useful but does not fruit quite so early in June as the introduced white mulberry (*Morus alba*). The Russian mulberry has been widely recommended, attracts birds remarkably, and in some cases has been established in Massachusetts, but it appears not to be hardy on the higher lands of the State, and seems to require special treatment to establish it here. The Downing (or the New American, which appears to be identical) is a cultivated variety with a fruit

Tupelo or sour gum.

that is much more palatable than the common kinds, and has been successfully grown here. The dwarf white mulberry also seems hardy and gives a crop of fruit a few years after planting.

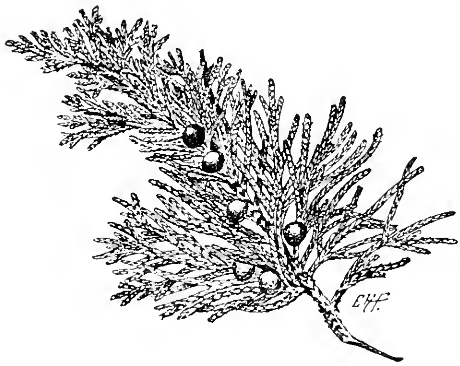
The mulberries make fine shade and ornamental trees, but should not be planted where they will overhang walks or buildings, as the decaying juicy fruit, if not all eaten by birds, drops to the ground in summer, where it is crushed by the feet of passers-by and disfigures walks or stains clothing. Wild blackberries, raspberries, blueberries and huckleberries all are eaten by birds in summer and all attract them. All wild cherries tempt the birds in July, August or September. There is a prejudice against these trees because they harbor tent caterpillars, which, however, may be killed by early spraying, but if wild cherries are not present many birds will be likely in August and September to go where they can be found or to attack cultivated fruit. Any crusade for the extermination of wild cherry trees will fail, as they may be found not only in yards, fields, pastures and along the roadsides, but almost everywhere in the woods.



Smilax, greenbrier, bull brier.

In September or October practically all the later wild fruits ripen, and, as many of them remain on the stems all winter, and some until spring, it is only necessary to have them in sufficient variety to provide winter food for fruit-eating birds. A few of these fruits, however, are particularly important as well as ornamental. Some are not eaten much by birds while the softer and more desirable fruits are at their best, but later they remain intact during the inclement months, when frost and storms have destroyed or covered other fruit, and then they offer nutriment to the birds in time of need. Such are the American and European mountain ash, the various sumacs, the junipers and the black alder (*Ilex verticillata*). The fruit of the mountain ash is very rich and ornamental in color, and rarely is disturbed by birds until the dead of winter, when they seek it eagerly. The foliage of the sumacs is brilliant in autumn, while the fruit, as well as that of the black alder, is handsome and remains on the stem for the winter birds. The catkins of the birches and of the common alder are sought for their seeds by winter birds. It is essential to provide berries and seeds on shrubs and trees well above the snow for winter food.

All trees that are attacked by many insects are favorites with birds. Many hundreds of species of insects infest the apple, oak, poplar, willow, birch and alder. Hence these trees are desirable. The coniferous trees are not subject to the attacks of such a variety of insects, nevertheless certain species sometimes become numerous upon them. The white pine is a favorite with titmice and kinglets in winter, as they often find the eggs of aphides on these trees in enormous numbers. The seeds of coniferous trees are eaten by a few species of birds. Elms ripen their seeds early, thus providing food for birds in early summer, while the spanworms that infest elms and apple trees are sought by nearly all birds.

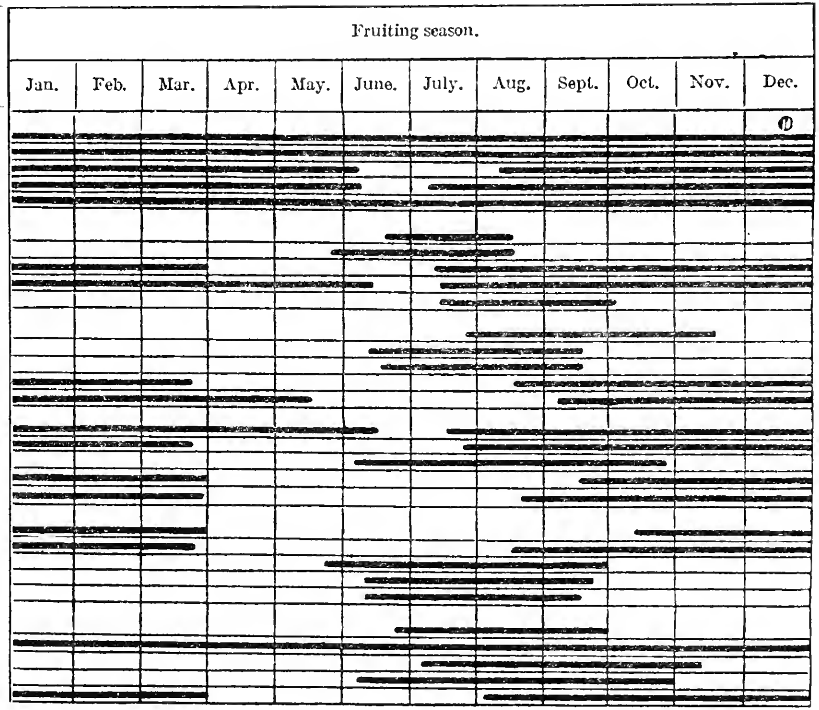


Virginia juniper or red cedar.

Mr. W. L. McAtee of the Biological Survey, who has made a special study of fruits attractive to birds, has published in Farmers' Bulletin 621, entitled "How to attract Birds in Northeastern United States," the following table, showing the seasons in which different fruits are available for birds: —

TABLE 1. — *Seasons of Fruits attractive to Birds.*

COMMON NAME.	Scientific Name.	Native or introduced.
Juniper,	*Juniperus communis,*	Native
Red cedar,	*Juniperus virginiana,*	Native
Greenbrier,	*Smilax rotundifolia,*	Native
Bayberry,	*Myrica carolinensis,*	Native
Hackberry,	*Celtis occidentalis,*	Native
Red mulberry,	*Morus rubra,*	Native
White mulberry,	*Morus alba,*	Introduced
Pokeweed,	*Phytolacca decandra,*	Native
Barberry,	*Berberis vulgaris,*	Introduced
Sassafras,	*Sassafras variifolium,*	Native
Spice bush,	*Benzoin aestivale,*	Native
Wild gooseberry,	*Ribes cynosbati,*	Native
Red currant,	*Ribes vulgare,*	Introduced
Asiatic currant,[1]	*Ribes fasciculatum,*	Introduced
Flowering crab apple,	*Pyrus floribunda,*	Introduced
Chokeberry,	*Pyrus melanocarpa,*	Native
Mountain ash,	*Pyrus americana,*	Native
June berry,	*Amelanchier canadensis,*	Native
Asiatic service-tree,[2]	*Amelanchier asiatica,*	Introduced
Cockspur thorn,	*Crataegus crus-galli,*	Native
Washington thorn,	*Crataegus phaenopyrum,*	Introduced
English thorn,	*Crataegus oxyacantha,*	Introduced
Wild strawberry,	*Fragaria americana,*	Native
Wild blackberry,	*Rubus allegheniensis,*	Native
Wild blackberry,	*Rubus triflorus,*	Native
Wild blackberry,	*Rubus canadensis,*	Native
Pasture rose,[1]	*Rosa humilis,*	Native
Wild black cherry,	*Prunus serotina,*	Native
Wild red cherry,	*Prunus pennsylvanica,*	Native
Beach plum,[1]	*Prunus maritima,*	Native



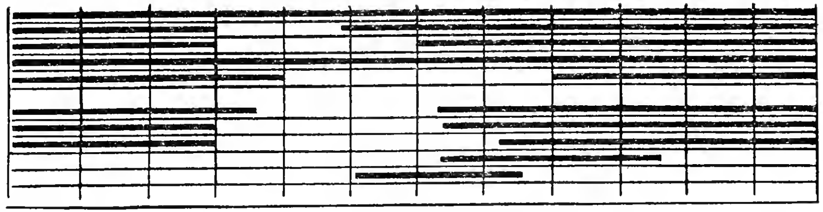
[1] Fruit becoming dry at end of season.

[2] Apparently procurable only from foreign dealers.

TABLE 1. — *Seasons of Fruits attractive to Birds* — Concluded.

COMMON NAME.	Scientific Name.	Native or introduced.	Fruiting season. Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sand cherry,	*Prunus pumila*,	Native												
Crowberry,	*Empetrum nigrum*,	Native												
Smooth sumac,	*Rhus glabra*,	Native												
Fragrant sumac,	*Rhus aromatica*,	Native												
Holly,[1]	*Ilex opaca*,	Native												
Inkberry,[1]	*Ilex glabra*,	Native												
Black alder,[1]	*Ilex verticillata*,	Native												
Mountain holly,[1]	*Nemopanthus mucronata*,	Native												
Bittersweet,	*Celastrus scandens*,	Native												
Buckthorn,	*Rhamnus cathartica*,	Introduced												
Virginia creeper,	*Psedera quinquefolia*,	Native												
Japanese creeper,[2]	*Ampelopsis tricuspidata*,	Introduced												
Summer grape,[2]	*Vitis aestivalis*,	Native												
Frost grape,	*Vitis vulpina*,	Native												
Leatherwood,	*Dirca palustris*,	Native												
Wild pepper,	*Daphne mezereum*,	Introduced												
Oleaster,[2]	*Elaeagnus angustifolia*,	Introduced												
Buffalo berry,	*Shepherdia canadensis*,	Native												
Wild sarsaparilla,	*Aralia nudicaulis*,	Native												
Asiatic sarsaparilla,[2]	*Acanthopanax sessiliflorum*,	Introduced												
Bunchberry,	*Cornus canadenis*,	Native												
Flowering dogwood,	*Cornus florida*,	Native												
Red osier,[2]	*Cornus stolonifera*,	Native												
Alternate-leaved dogwood,	*Cornus alternifolia*,	Native												
Sour gum,	*Nyssa sylvatica*,	Native												
Wintergreen,	*Gaultheria procumbens*,	Native												
Bearberry,	*Arctostaphylos uva-ursi*,	Native												
Creeping snowberry,	*Chiogenes hispidulus*,	Native												
Black huckleberry,	*Gaylussacia baccata*,	Native												
Early sweet blueberry,	*Vaccinium pennsylvanicum*,	Native												
Swamp blueberry,	*Vaccinium corymbosum*,	Native												
Cranberry,	*Vaccinium macrocarpon*,	Native												
Persimmon,[1]	*Diospyros virginiana*,	Native												
Privet,	*Ligustrum vulgare*,	Introduced												
Purple berry,	*Callicarpa purpurea*,	Introduced												

Partridge berry, . .	*Mitchella repens,* . .	Native
Fly honeysuckle,[2] . .	*Lonicera caerulea,* . .	Native
Tartarian honeysuckle,[2] .	*Lonicera tatarica,* . .	Introduced
Snowberry, . . .	*Symphoricarpos racemosus,*	Native
Coralberry, . . .	*Symphoricarpos vulgaris,* .	Native
High-bush cranberry, .	*Viburnum opulus,* . .	Native
Arrowwood, . . .	*Viburnum acerifolium,* .	Native
Sheepberry, . . .	*Viburnum lentago,* . .	Native
Common elder, . .	*Sambucus canadensis,* .	Native
Red-berried elder, . .	*Sambucus racemosa,* . .	Native



[1] Sexes tending to be on separate plants: both required.

[2] Fruit becoming dry at end of season.

Note — This and the lists of plants in succeeding pages have been inserted practically as they were published originally. No attempt has been made by the author to correct them or to bring the evanescent nomenclature up to date.

The plants given in the above list are selected from a much larger number, all of which are known to be favorites with birds, and are such as are likely to be secured through the ordinary channels of trade. The fruiting seasons include the earliest and latest dates recorded for New York and New England, and it cannot be expected that fruit will be available at any one locality throughout the entire season given, unless a large number of plants are set in a variety of situations. Mr. McAtee also gives the following valuable notes on the foregoing list: —

Bayberry. Usual trade name is *Myrica cerifera*.

Hackberry. Fruit scarce in late May and June. *Celtis serrata*, *C. bungeana* or *C. mississippiensis* may be substituted.

Mulberry. *Morus tatarica* may be used.

Pokeweed. Let it grow through shrubs or a trellis which will support it in winter.

Barberry. *Berberis amurensis*, *B. aristata*, *B. regeliana* and *B. rehderiana* are good substitutes. The universally planted *B. thunbergi* seems to be of very little value as bird food.

Sassafras. Appears in most catalogues as *S. officinale* or *S. sassafras*.

Flowering apple. The following may be substituted: *P. baccata*, *P. halliana*, *P. parkmanni*, *P. sargentii* and *P. toringo*.

Chokeberry. Often called *Pyrus* or *Aronia nigra*. *P. arbutifolia*, another native species, retains its fruit just as long, but the fruit becomes very dry toward the end of the season.

Cherry. *Prunus cerasifera*, *P. fruticosus*, *P. japonica pendula*, *P. sargentii* and *P. tomentosa*, all introduced, are worth adding.

Sumac. *Rhus copallina* or *R. hirta* (*typhina*) may be substituted for *R. glabra*.

June berry. *Amelanchier canadensis*, sold by nurserymen, is a composite species. Several species are now recognized, among which *A. lævis* is a notably early fruiter and *A. sanguinea* a late one. Some fruit of June berries occasionally hangs much later than the season indicated, but in very dry condition.

Thorns. The species recommended are those usual in the trade. So far as desirability is concerned many native species could be substituted. Cotoneasters, such as *C. coccinea*, *C. horizontalis*, *C. microphylla*, *C. rotundifolia* and *C. tomentosa*, may also be used.

Strawberry. Often called *Fragaria vesca* var. *americana*. *F. virginiana* is a fair substitute. Little dealt in; must usually be transplanted from woods and fields.

Blackberry. *Rubus t iflorus* is frequently called *R. americanus*.

Rose. All native species have persistent fruit. The small-fruited ones are best for birds. *Rosa carolina* and *R. nitida* are suitable for low grounds, and *R. humilis* (sometimes called *virginiana*) and *R. setigera* may be planted in drier places. *R. micrantha* and *R. multiflora* are among the best introduced roses.

Black alder. *Ilex lævigata* may be used instead of *I. verticillata*. *I. serrata* is a good introduced species.

Mountain holly. Drops most of its berries in the fall; only a few persist throughout the season indicated.

Bittersweet. *Celastrus orbiculatus*, introduced, may be used.

Buckthorn. *Rhamnus dahurica* is equally good.

Virginia creeper. Often sold under the names *Ampelopsis* and *Parthenocissus*. *A. heterophylla* and *P. vitacea* may be substituted.

Wild pepper. *Hippophaë rhamnoides* may replace it, especially along coast.

Oleaster. *Elæagnus longipes*, *E. multiflora*, *E. parviflora* and *E. umbellata* also are good.

Buffalo berry. *Shepherdia* (*Lepargyrea*) *argentea*, the true buffalo berry, furnishes good bird food.

Dogwood. *Cornus paniculata* (*candidissima*), native, and *C. alba* and *C. sanguinea*, introduced, are worthy substitutes.

Huckleberry. *Gaylussacia baccata* is often sold as *G. resinosa*.

Blueberry. Any species may be substituted.

Cranberry. Generic name often given as *Oxycoccus*.

Privet. *Ligustrum acuminatum*, *L. amurense*, *L. ciliatum*, *L. ibota* and *L. microcarpum*, all introduced, are equally good. Must not be clipped; berries borne on outer twigs.

Purple berry. Variety *japonica* is the hardy form.

Honeysuckle. *Lonicera glauca*, *L. canadensis*, *L. oblongifolia* and *L. sempervirens*, native, and *L. maackii*, introduced, may be substituted.

Snowberry. *Symphoricarpus occidentalis* is just as good.

Viburnum. *V. dentatum*, native, and *V. sieboldii*, introduced, are worth adding.

Elder. *Sambucus nigra*, introduced, also is valuable.

It will be noted that the list given by Mr. McAtee includes both native and introduced species, but for those who prefer to raise their own plants, or to encourage such native plants enticing to birds, as already grow on their land, the following list, first published by Mr. F. H. Kennard in "Bird-Lore" for July–August, 1912, is recommended as showing the comparative attractiveness of the various species.

Those plants that are particularly tempting to birds are shown with three asterisks, while those with more than ordinary attractiveness are shown by one or two asterisks, in the order of their attractiveness; and those species of which the fruits seem to be eaten so seldom as to make their planting barely worth while are marked with a dagger.

Deciduous Trees.

Acer negundo, ash-leaved maple, box elder.
**Acer saccharum*, sugar maple; and doubtless other maples.
Betula populifolia, American gray birch.
Betula lutea, yellow birch; and probably other birches.
Celtis occidentalis, hackberry.
Cercis canadensis, red-bud.
***Cornus florida*, flowering dogwood.
†*Corylus americana*, American hazel.
**Cratægus coccinea*, white thorn.
**Cratægus crus-galli*, cockspur thorn; and others of this genus.
†*Fagus americana*, American beech.
Fraxinus americana, American white ash; and probably other species.
†*Hicoria* sp. Several kinds of hickory.
Ilex opaca, American holly.
†*Liquidambar styraciflua*, sweet gum.
†*Liriodendron tulipifera*, tulip tree.
***Morus rubra*, native red mulberry.
**Nyssa sylvatica*, tupelo.
Ostrya virginiana, hornbeam.
†*Plantanus occidentalis*, sycamore.
†*Populus* sp. Various species of poplars are sometimes fed upon.
***Prunus pennsylvanica*, bird cherry.
***Prunus pumila*, sand cherry.
***Prunus serotina*, black cherry.
***Prunus virginiana*, choke cherry.
**Pyrus americana*, mountain ash.
†*Quercus* sp. Several species of oaks.
Sassafras officinalis, sassafras.
Ulmus americana, American elm.
And other species.

Evergreen Trees.

**Juniperus virginiana*, red cedar.
**Juniperus communis*, prostrate juniper.
**Picea alba*, white spruce.
**Picea rubra*, red spruce; and undoubtedly other species.
Pinus rigida, pitch pine.
Pinus strobus, white pine.
Tsuga canadensis, hemlock.

Shrubs.

**Amelanchier canadensis*, June berry.
**Benzoin odoriferum*, spice bush.
Berberis vulgaris, barberry.
Comptonia asplenifolia, sweet fern.
Corema conradii, broom crowberry.
***Cornus alternifolia*, blue cornel.
***Cornus candidissima*, gray cornel.
***Cornus sericea*, silky cornel.
***Cornus stolonifera*, red osier cornel.
**Gaylussacia frondosa*, dangleberry.
**Gaylussacia resinosa*, huckleberry.
**Ilex glabra*, inkberry.
**Ilex verticillata*, black alder; and probably *I. lævigata*, winterberry, black ilex.
Ligustrum vulgare, privet.
**Myrica cerifera*, bayberry.
Prunus maritima, beach plum.
Pyrus arbutifolia, chokeberry.
Rhamnus catharticus, buckthorn.
***Rhus copallina*, shining sumac.
***Rhus glabra*, smooth sumac.
***Rhus toxicodendron*, poison ivy.
***Rhus typhina*, staghorn sumac.
***Rhus venenata*, poison sumac.
**Ribes floridum*, large-flowering currant.
**Ribes lacustre*, swamp gooseberry; and other species.
**Rosa*, sp. It is probable that the fruits of all the native wild roses are eaten largely by birds.
***Rubus occidentalis*, thimbleberry.
***Rubus strigosus*, red raspberry.
***Rubus canadensis*, low blackberry.
***Rubus villosus*, high blackberry.

***Sambucus canadensis*, common elder.
***Sambucus pubens*, panicled elder.
Shepherdia canadensis, shepherdia.
***Symphoricarpos racemosus*, snowberry.
****Vaccinium cæspitosum*, dwarf bilberry.
****Vaccinium corymbosum*, high-bush blueberry.
****Vaccinium pennsylvanicum*, low-bush blueberry; and doubtless other species, including *V. vitisidæa*, cowberry.
***Viburnum alnifolium*, hobble bush.
***Viburnum dentatum*, arrow-wood.
***Viburnum lentago*, sheepberry.
***Viburnum nudum*, withe-rod.
***Viburnum opulus*, high-bush cranberry.
***Viburnum prunifolium*, black haw; and doubtless *V. acerifolium*, *V. cassinoides*, and other species.

Vines.

***Ampelopsis quinquefolia*, Virginia creeper.
Arctostaphylos uva-ursi, bearberry.
Celastrus scandens, false bittersweet.
Menispermum canadense, moonseed.
Mitchella repens, partridge berry.
Vaccinium macrocarpon, cranberry.
Vaccinium oxycoccus, dwarf cranberry.
**Smilax rotundifolia*, bull brier.
***Vitis cordifolia*, frost grape.
***Vitis labrusca*, fox grape.
***Vitis vulpina*, frost grape.

Herbaceous Plants.

***Aralia nudicaulis*, sarsaparilla.
Fagopyrum esculentum, buckwheat.
***Fragaria virginiana*, strawberry.
Gaultheria procumbens, checkerberry.
Helianthus annuus, sunflower.
***Phytolacca decandra*, pokeberry.
Smilacina racemosa, false spikenard.
Solanum nigrum, nightshade.

It should be noted that the poison ivy and the poison sumac are undesirable for indiscriminate planting, and that the barberry, although generally regarded as a native, is, as Mr. Kennard remarks, an introduced species.

The first deciduous tree on the above list, the ash-leaved maple or box elder, is noteworthy as a favorite of the evening grosbeak while wintering here, and it seems probable that since this beautiful bird has become a winter resident here in recent years it might be induced to come and remain in larger numbers if many of these trees were planted.

The American beech, while not attractive to small birds, furnishes in its fruit a supply of food in autumn for ducks and grouse. The oaks, which supply much insect food for many birds, also furnish food in the form of acorns for ducks, grouse, jays and crows. My own experience goes to show that *Cornus alternifolia* is most important among the cornels. The Virginia creeper or woodbine is useful, as its fruit is sought by thrushes. Among the herbaceous plants the pokeweed and the sunflower may be mentioned as favorites with birds. When raising sunflowers the giant Russian variety is best. If well fertilized it produces gigantic flowers and a large quantity of huge seeds which are much sought after by the brilliant goldfinch, the purple finch, the nuthatches and the chickadee. Buckwheat always attracts the mourning dove and is likely to lure bobwhite.

Food Plants for Native Sparrows and Ground Birds.

All native sparrows are fond of weed seeds. Doves, grouse, bobwhites and pheasants eat them also and wild fowl resort to them more or less. Hence weedy cultivated fields and gardens are favorite haunts for seed-eating birds in autumn.

I have found nothing better for attracting native sparrows than the Japanese millet (*Panicum crus-galli*), a cultivated weed or barnyard grass. A small patch of this sowed on land that has first been plowed, harrowed well and manured will attract all the native sparrows in the neighborhood when the seed ripens, as well as the migratory species from the north. If several patches be sown from early May to late June in different localities they will ripen their seed at different times and provide food from late August until winter. Mr. McAtee recommends also the following for sparrows: —

"Love-lies-bleeding (*Amaranthus caudatus*), prince's feather (both *Amaranthus hypochondriacus* and *Polygonum orientale*), yellow chamomile (*Anthemis tinctoria*), chamomile (*Anthemis nobilis*), *Calandrinia umbellata*, bachelors button (*Centaurea cyanus*), African millet (*Eleusine coracana*), California poppy (*Eschscholzia californica*), tarweed (*Madia elegans*), miners lettuce (*Montia perfoliata*), millet (*Panicum miliaceum*), . . . German millet or Hungarian grass (*Setaria italica*), and sunflower. Several of the species of sunflower will serve, the common sunflower (*Helianthus annuus*) being one of the best, having named varieties especially prized for the abundance and large size of the seed. No seeds are more relished by graminivorous birds than the millets; in fact, they are so much preferred that they have been used with good effect for drawing the attention of birds from more valuable grain crops." [1]

In my "Useful Birds and their Protection," fourth edition, 1913, published by the Massachusetts State Board of Agricul-

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[1] McAtee, W. L., Plants Useful to attract Birds and protect Fruit. Year book, United States Department of Agriculture 1909, p. 193.

ture, two lists of plants attractive to birds are given, pages 374 to 376 and pages 430 to 432. For lack of space and because they would largely duplicate the two lists above they cannot be repeated here, nor can the long lists of food plants of the ruffed grouse and bobwhite, printed in my "Game Birds, Wild Fowl and Shore Birds," be included in this circular, but for the convenience of those who wish to attract game birds the following by Mr. McAtee from the Yearbook of the United States Department of Agriculture for 1909 is appended: —

While the establishment of preserves for land game birds is yet a new movement in this country, it is certain to become of great importance. Hence it is desirable to disseminate information as to the food and covert plants that are favored by the grouse and quail. Bobwhites frequently use covers of rose, alder and blackberry bushes, and thickly set barberry, bayberry and dense banks of honeysuckle are suitable. These plants also furnish food for the birds, but they should be supplemented by others more exclusively adapted for this purpose. Sumac, Japanese clover, buckwheat, sorghum, millet, vetches, cowpeas, and any plants of the pea family producing small seeds, are valuable and should be sown in large quantities. The seeds of milk pea (*Galactia*), partridge pea (*Chamaechrista*), hog peanut (*Falcata*), wild bean (*Strophostyles*), and smartweeds (*Polygonum*) are important natural foods of the eastern quail, but should be encouraged only where they cannot become weed pests. The western quail are fond of the seeds of sumac, but clover, alfilaria, lupines, napa thistle and turkey mullein plants; but where these plants are liable to become nuisances the food plants recommended for the eastern quail will serve.

Coverts for grouse, as the sharptail, should abound in such plants as rose, sumac, blueberry, bearberry, buffalo berry, dwarf birch and alder. The ruffed grouse thrives among scrub oak, bayberry, rose, sumac, dwarf birch, alder, poplar, willow and such fruit-bearing plants as partridge berry, hawthorn, viburnum, wild grapes, mountain ash, blueberry, blackberry and cranberry. Cover of this nature is suited to the heath hen also, and to the imported pheasants and the Hungarian partridge, but in all cases it is well to supplement the food supply furnished by these shrubs and trees by planting small grains and legumes, as recommended for quail.

Some of the plants named in the above list are not native to New England, and probably the cowpea and the milk pea will not mature in Massachusetts, but most of them can be utilized here.

It is impossible within the limits of this circular to give even a list of the important plants which attract wild ducks and geese, but information regarding some of the most useful of such plants may be found in the following publications of the United States Department of Agriculture: Bureau of Biological Survey, Circular 81, and Department of Agriculture Bulletins 58 and 205. All may be obtained of the Superintendent of Documents, United States Department of Agriculture, Washington, District of Columbia.

Plants for Protecting Cultivated Fruits.

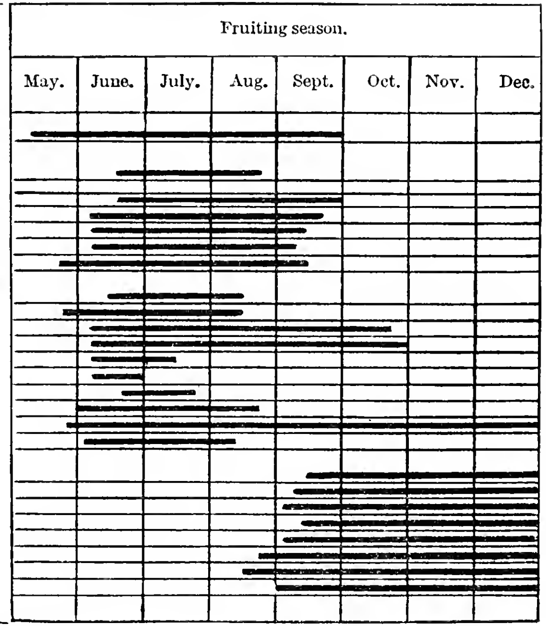
The chief fruit-eating birds in Massachusetts are the robin, the catbird and the cedar waxwing. The flicker, English sparrow, Baltimore oriole and a few other species occasionally are mischievous, and the starling, a recent introduction from the Old World, seems likely to become most destructive of all. Cherries are most often attacked by fruit-eating birds, but all small fruits are eaten by them. It is not good biology to shoot birds for taking fruit. It is better to provide fruit enough for ourselves and the birds, and thus retain their services as insect destroyers. It will pay the fruit grower to lure them away from his cultivated cherries and berries, if possible, by setting out plants that bear earlier and more attractive fruit. My experiments with the native red mulberry were successful in protecting cherries, and I have watched a garden where a single tree of the Downing mulberry entirely protected several trees of cultivated cherries of the harder varieties. No native bird troubled the cherries although the English sparrows occasionally pecked one. I have learned from fruit growers in New Jersey that mulberry trees protected their cherry crops from robins even in a very dry season, when robins elsewhere had been destructive to the fruit. The Russian mulberry is very early and will grow in southeastern Massachusetts. Elsewhere in the State, as hereinbefore stated, the white mulberry, the red or the Downing or New American would serve. The advantages of the Downing or New American are that it is a quick grower and fruiter, bears very early in the season and appears to be perfectly hardy, at least in eastern Massachusetts.

Mr. G. T. Powell tried the experiment of planting a row of soft early cherries known as the Governor Wood. The birds took them, leaving untouched choice varieties, such as Montmorency and Richmond. Another fruit grower, having a row of soft cherries and finding that the birds took most of them, cut down the trees. The birds then attacked the main orchard.

Mr. McAtee in Farmers' Bulletin 621 gives the following table, showing the seasons of fruits useful in protecting cultivated varieties: —

TABLE 2. — *Seasons of Fruits useful to protect Cultivated Varieties.*

COMMON NAME.	Scientific Name.	Native or introduced.	To protect —
Wild strawberry,	*Fragaria americana*,	Native	Strawberries,
Baked-apple berry,	*Rubus chamaemorus*,	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus canadensis*,	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus allegheniensis*,	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus triflorus*,	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus frondosus*,	Native	Raspberries and blackberries,
Wild pepper,	*Daphne mezereum*,	Introduced	Raspberries and blackberries,
Red mulberry,	*Morus rubra*,	Native	Cherries,
White mulberry,	*Morus alba*,	Introduced	Cherries,
June berry,	*Amelanchier canadensis*,	Native	Cherries,
Wild red cherry,	*Prunus pennsylvanica*,	Native	Cherries,
Japanese cherry,	*Prunus japonica pendula*,	Introduced	Cherries,
Sargent cherry,[1]	*Prunus sargentii*,	Introduced	Cherries,
Mahaleb cherry,	*Prunus mahaleb*,	Introduced	Cherries,
Fly honeysuckle,	*Lonicera canadensis*,	Native	Cherries,
Fly honeysuckle,	*Lonicera caerulea*,	Native	Cherries,
Red-berried elder,	*Sambucus racemosa*,	Native	Cherries,
Asiatic service-tree,[1]	*Amelanchier asiatica*,	Introduced	Apples and pears,
Silky-leaved pear,[1]	*Pyrus elaeagrifolium*,	Introduced	Apples and pears,
Flowering crab apple,	*Pyrus floribunda*,	Introduced	Apples and pears,
Dwarf crab apple,	*Pyrus toringo*,	Introduced	Apples and pears,
Hybrid crab apple,[1]	*Pyrus prunifolia*,	Introduced	Apples and pears,
Cockspur thorn,	*Crataegus crus-galli*,	Native	Apples and pears,
English thorn,	*Crataegus oxyacantha*,	Introduced	Apples and pears,
One-seeded thorn,	*Crataegus monogyna*,	Introduced	Apples and pears,



[1] Apparently procurable only from foreign dealers.

Other Means of Protecting Fruit.

Birds eat fruit not only for food but for the juices, which often serve to take the place of water in dry weather. A drinking fountain or a brook close at hand may serve to take some of their attention from the fruit. Newly turned sod also may attract robins and some other birds away from fruit, as they seem to prefer worms and grubs. A fertile, well-watered lawn sometimes answers the same purpose, as it keeps the earthworms near the surface where the robins can find them.

As a last resort, where one has but one or two cherry trees and no room for experiments, the trees may be covered with a fine-meshed fish net, but birds may become entangled in the net.

Plants for the Seashore.

Mr. McAtee in his excellent bulletin (621) gives the following hints regarding plants for attracting birds at the seaside: —

> Where the coast is rocky and the soil of ordinary character, conditions are little different from those inland, and except in relation to exposure there need be no especial preference given in the choice of plants. It is worth mentioning, however, that several trees and shrubs are better adapted to withstand the winds so prevalent on the coast. These include three species of juniper (*Juniperus communis, J. horizontalis* and *J. virginiana*), common barberry, English thorn, hybrid crab apple, European and American mountain ashes, smooth and staghorn sumacs, privets, buckthorn and red-berried elder. Where the soil is chiefly sand, and that often shifting, conditions are not suited to many plants. Selection may be made, however, from the following, all of which are known to thrive in such surroundings: —
>
> *For Seed Eaters.* — Beach grass (*Ammophila arenaria* and *Calamovilfa longifolia*), *Polygonum sachalinense* and sunflower.
>
> *For Fruit Eaters.* — Bayberry (*Myrica cerifera*), sea buckthorn (*Hippophaë rhamnoides*), sand cherry (*Prunus pumila* or *P. cuneata*), beach plum (*Prunus maritima*), cranberries and bearberry (*Arctostaphylos uva-ursi*).

How to Plant.

Inexperienced planters are likely to fail even if provided with excellent plants or seeds. The common plan of sticking seeds into little holes in the sod or leaf mold is foredoomed to failure, as only a very small percentage of the seeds ever succeed. The resulting young plants are exposed to many enemies and must compete with other well-established plants which surround them. If seeds are used they should be planted in rows about nine inches apart, near the surface, in a box of good loam, where they can be watched, weeded and cared for, or in a well-prepared bed surrounded with boards and covered with "cellar wire" netting to keep out mice, rabbits, squirrels and other enemies. If planted in the fall they should be mulched the first winter. When they have outgrown this little nursery they may be replanted in nursery rows or set in the ground where they are to remain.

Plants from the nurseryman, if well cared for and properly packed, should be moist about the roots when received. The bundles should be unpacked as soon as possible, the bunches loosened enough so that all the roots may come in contact with the earth that is to receive them and they should be "heeled in" or covered at once in a trench in moist earth on the north side of a building or in a cool cellar. A brief exposure to sun and wind is enough to destroy both root hairs and rootlets. If at all dry when received the roots should be immersed in water before heeling in. Plants thus treated may be left with safety while the ground is being prepared to receive them. Young trees arriving with the roots dried out will sometimes recover if the top be cut back severely and the entire tree immersed for a few days in moist earth before planting.

The poorest possible way to set out a tree is to dig a little hole in old sod and set the tree in it.

The best way is to set all trees in land that has been well cultivated and manured for at least two or three years previous to the setting. Vigorous young trees from one to three feet high will make a better growth when transplanted than those that are older. There is no advantage for our purpose in bringing larger trees from the nursery. Trees may be started well in poor gravelly land by digging out a hole about two feet deep and large enough to hold a cartload of loam, in which the tree is set.

When setting out trees it is well to plow or trench the soil deeply and fine it well. I have had excellent success on poor soil by digging holes about eighteen inches deep and five feet in diameter and putting in with the loam some ground bone and chip dirt.

Before setting a tree its roots should be examined, and if any have been mangled or broken they should be trimmed back with a sharp knife. The top should be cut back in proportion to the injury to the roots. It is better, as a rule, to have the tree more nearly resemble a bean pole in shape than a tree when set out. The soil should not be wet nor dry at planting time, but moist and crumbly, so that it may be readily worked in among the roots. While planting, the roots should be not exposed to sun and air but should be kept covered in moist earth or with wet burlap until wanted. Some nurseryman before planting puddle the roots in mud made of rich, fine loam. The tree is then set in the hole prepared for it, the roots spread in their natural positions and the earth packed firmly among and around them. In this work both hands and feet should be used and no cavities among the roots should be left unfilled. It is important that the soil about the roots be very fine and well packed, and the surface should be left light, to prevent evaporation. In light soil the tree should be set a little deeper than in the nursery row, and it may be necessary to water it or to mulch it deeply the first year.

When large trees are to be transplanted it should be done by an expert, as the novice is likely to make an expensive failure. The directions given for planting trees may be observed to advantage in setting out vines and shrubs, modifying the operation to suit the various sizes and conditions. Any capable nurseryman should be able to furnish information regarding plants suitable for dry or wet soil or for planting in sunny or shady places.

NOTE. — The author will be glad to receive any information on any of the subjects treated in this bulletin. Address EDWARD HOWE FORBUSH, 136 State House, Boston, Mass.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 50.

SECOND EDITION, REVISED.

July, 1916.

APPLE GRADING AND PACKING.

THE UNITED STATES STANDARD BARREL LAW,
THE UNITED STATES APPLE GRADING LAW AND
THE MASSACHUSETTS APPLE GRADING LAW.

WILFRID WHEELER, *Secretary.*

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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1916.

APPROVED BY
THE STATE BOARD OF PUBLICATION.

APPLE GRADING AND PACKING.

THE UNITED STATES STANDARD BARREL LAW, THE UNITED STATES APPLE GRADING LAW AND THE MASSACHUSETTS APPLE GRADING LAW.

PREPARED BY H. LINWOOD WHITE, FIRST CLERK,
Under the direction of WILFRID WHEELER, *Secretary, Massachusetts State Board of Agriculture.*

INTRODUCTION.

Massachusetts' climate and soil are as well adapted to raising apples as any to be found. Massachusetts growers are as capable and as intelligent as any; they produce just as good apples as are grown anywhere and, when flavor is considered, better apples than are produced in the most famous apple-growing regions. Massachusetts markets are unexcelled.

With climate, soil, farmers, markets and product there remains the most important operation, — that of marketing. Hitherto the Massachusetts grower has suffered from competition with out-of-state producers who, through necessity of self-preservation, have developed and adopted the most scientific methods of culture, picking, grading, packing and marketing. In Massachusetts, with markets so close at hand and with a system of mixed farming in vogue, the need for improvement in the practice of raising and marketing apples has not been so pressing. It was only after the first New England fruit show in 1909 that Massachusetts apple growers came to realize their capabilities. The fruit shows held subsequently, together with a propaganda of better methods in pruning, spraying and packing, have resulted in a veritable boom of the orchard industry, but the fashion of growing more of something better will last only so long as the grower is profitably rewarded for the effort.

Grading cloth, paper, cotton, wool, oranges and tobacco has long been practiced. The fruit growers of California, Oregon, Washington and the British northwest have staked their reputations on grades and brands, and have profitably sold their products in markets 3,000 miles distant.

Massachusetts apples have been packed in all sorts of containers, with regard only for the facts that a barrel is a barrel and a box is a box. Massachusetts apples have been sold as "Fancy," "Extra," "XXXX," "XXX," "No. 1," or "No. 2," and graded in each case in accordance with the ideas of the individual packer. Ungraded apples have been placed on the market with no marks to distinguish them from graded, to the detriment of the reputation of the latter. No. 1 Baldwins from one section might be classed as No. 2 in another, or *vice versa,* and apples possessing all the defects of windfalls labeled No. 1's, and sold as such.

Such practices by several thousand individual growers, with no ideas in common as to the qualifications of a "Fancy" or "No. 1" or "No. 2" apple, could never establish in the minds of either dealers or consumers a proper regard for Massachusetts apples. Further than this there has been little or no attempt on the part of any group of growers to co-operate for the purpose of determining and adopting uniform grades and labels.

Apple grading legislation until recently has been unnecessary in the big apple States of the west; the growers have been compelled through their associations to adopt grading, packing and shipping regulations for themselves, and these have been in force for many years. The State of Maine passed a grading law in 1910, New York in 1914, and the States of Vermont, Connecticut and Massachusetts in 1915. The laws of the last three-named States are based on a bill prepared by a committee representing all phases of the apple industry. This committee was selected by the Boston Chamber of Commerce. The best points of existing laws were considered in the construction of the bill, and many new features were added, after a number of hearings and conferences at which growers, dealers and consumers from the six New England States signified their approval of the measure.

The primary object of the Massachusetts Apple Grading Law is a bigger and more profitable orchard industry, based mainly on securing more uniform and stable prices for the product. This can be done only by the adoption of grading and marking standards, so that the purchaser may be sure he is getting what he pays for. The means in attaining this object is education through publication, demonstration and inspection.

The publication and distribution of this circular of information was the first step in this direction. It seeks to answer every query concerning standard closed packages, standard grades and marks or brands required to be used on closed packages. Correspondence concerning, and discussion of, points not covered are solicited.

Appended to this circular are the texts of the United States Standard Barrel Law, the United States Apple Grading Law and the Massachusetts Apple Grading Law. The regulations authorized by sections 6 and 11 of the last-named law will be found in the body matter of the following pages.

UNITED STATES STANDARD BARREL LAW.

The Federal Standard Barrel Law fixes a standard for the barrel just as standards for the quart, peck or bushel are fixed by law. The specifications coincide with those of the Massachusetts standard barrel. This law states that no barrel of less capacity (7,056 cubic inches) than the standard barrel, and containing fruits or vegetables or any other dry commodity, shall be sold, offered or exposed for sale in any State, territory or the District of Columbia, or shipped from any State, territory or the District of Columbia to any other State, territory or the District of Columbia, or to a foreign country. The use of third, half and three-quarter barrels, and reasonable variations and tolerances to be established by rules and regulations of the Federal Bureau of Standards, are permissible. These rules and regulations have not yet been published. The Standard Barrel Law went into effect July 1, 1916.

UNITED STATES APPLE GRADING LAW.

The United States Apple Grading Law, popularly known as the "Sulzer Bill," establishes a standard barrel for apples which is the same as the United States standard barrel for fruits, vegetables and other dry commodities. It defines three standard grades and provides a penalty for misbranding. It applies to apples packed in barrels only when shipped or delivered for shipment from one State to another or to a foreign country.

MASSACHUSETTS APPLE GRADING LAW.

The Massachusetts Apple Grading Law is an act to regulate the grading, packing, marking, shipping and sale of apples in closed packages. It applies to all apples in closed packages, packed or repacked in Massachusetts, and intended for sale either within or without the State, and also to apples grown in other States when such apples are graded and branded as conforming to the Massachusetts standard.

The law, and the regulations authorized thereby, went into effect July 1, 1916.

The law fixes a standard for barrels which is the same as the United States standard, and a standard for boxes uniform with standards of the principal apple-growing States; it defines a closed package; it establishes three standard grades and provides that all apples sold in closed packages not conforming to these three grades or, if conforming, not branded in accordance therewith, shall be deemed "UNGRADED" and so marked; it requires every closed package of apples packed or repacked within the State to be marked in a conspicuous place with certain information as to its contents; it specifies that closed packages containing apples packed or repacked without the State to be sold within the State as of a Massachusetts standard grade shall not be falsely marked; it authorizes the secretary of the State Board of Agriculture to make and publish rules and regulations for carrying out the provisions of the act; it empowers the said secretary and deputies to enter any building or other place where apples are packed, stored, sold or offered or exposed for sale and to open any closed package, and, upon tendering the market price, to take samples therefrom; it provides a maximum penalty of $50 for the first offence and a maximum penalty of $100 for subsequent violations of the law, but exempts from prosecution any person who appears to have acted in good faith solely as a distributor, or who can furnish a guaranty from the person from whom he received the apples that they are not adulterated or misbranded.

REGULATIONS.

As provided by section 11 of the law a public hearing was held at the State House, Boston, on Thursday, August 5, 1915. This was attended by representative growers, and by invited officials from other State departments of agriculture, the Massachusetts Agricultural College, the Massachusetts Fruit Growers' Association, the Massachusetts Department of Weights and Measures, and the County Farm Bureaus, as well as other interested persons.

As provided by section 11, several of the regulations issued by the secretary of the State Board of Agriculture as of September 1, 1915, under authority vested in him by sections 6 and 11 of the law, have subsequently been modified, and appear herein as adopted on July 1, 1916.

EXPLANATION OF REQUIREMENTS.

The specific requirements of the Massachusetts Apple Grading Law, the United States Standard Barrel Law so far as this applies to apple barrels, and the regulations, are herewith tabulated for ready reference.

"Closed Package" defined.

Regulation. — A barrel, box or other container, the contents of which cannot be seen sufficiently for purposes of inspection without removing nails, wire, hoops or metal, cloth or paper strips, or similar seals or contrivances which cannot ordinarily be removed without mechanical assistance or without destroying the usefulness thereof, except that string or tape unless sealed shall not be considered as having been destroyed when cut, broken or removed, shall be a "closed package" within the meaning of the law.

The following kinds of containers are hereby declared to be "closed packages:" —

Barrels provided with the usual closely fitting heads.

Barrels covered with burlap or other material through which the apples cannot readily be seen.

Boxes, including covers, made entirely of close-fitting boards when the covers thereof are nailed or otherwise securely fastened.

Boxes or cartons of corrugated paper, cardboard, metal or other material, the covers of which are sealed or otherwise fastened in such a manner as to prevent opening without damaging either the fastener or the container.

Baskets, the covers of which are sealed or otherwise fastened in such a manner as to prevent opening without damaging either the fastener or the container.

"Standard Barrel" defined.

Staves: length, $28\frac{1}{2}$ inches; thickness, not greater than $\frac{4}{10}$ of an inch.

Heads: diameter, inside of staves, $17\frac{1}{8}$ inches; distance between (inside measurement), 26 inches.

Bulge: circumference (outside measurement), 64 inches.

Capacity: 7,056 cubic inches.

Any barrel of a different form than this but of the same capacity, no matter what its dimensions, is a standard barrel. Particular reference is had to paper and steel barrels used in some parts of the country. A flour barrel is a standard barrel.

Apples must not be sold or offered or exposed for sale in any barrel that is of less capacity than 7,056 cubic inches, except that subdivisions of the standard barrel known as the third, half and three-quarters barrel may be used, provided their capacities, respectively, are at least one-third, one-half or three-quarters the capacity of the standard barrel (United States Standard Barrel Law).

"Standard Box" defined.

Length, 18 inches (inside measurement).

Width, $11\frac{1}{2}$ inches (inside measurement).

Depth, $10\frac{1}{2}$ inches (inside measurement).

Capacity, not less than $2,173\frac{1}{2}$ cubic inches.

A box of different dimensions or of a different capacity is *not* a standard box but may be used for packing for sale or distribution apples of standard grade.

"Standard Grades" defined.

For purposes of comparison the requirements for the several grades are grouped below: —

Apples when sold, or offered or exposed for sale in closed packages and not conforming to the specifications for the "Fancy," "A" and "B" grades or, if conforming, not branded in accordance therewith, shall be classed as "Ungraded," and so branded.

	"Fancy."	"A."	"B."	Ungraded
Variety, . .	Only one variety in the same package.	Only one variety in the same package.	Only one variety in the same package.	
Maturity, . .	Well matured but not overripe.	Well matured but not overripe.	Well matured but not overripe.	
How picked, .	Hand-picked.			
Color, . . .	Above medium in amount for the variety. Proportion of surface to be colored fixed by regulation (page 10).	Medium in amount for the variety. Proportion of surface to be colored fixed by regulation (page 10).	Less than medium in amount for the variety. Proportion of surface to be colored fixed by regulation (page 10).	
Shape, . .	Normal.	Normal.	Practically normal.	
Size, . . .	Good and reasonably uniform. Minimum size to be stated on the package. Minimum for each variety determined by regulation (see page 11).	Minimum size to be stated on package.	Minimum size to be stated on package.	Minimum size to be stated on package
Condition, . .	Sound.	Sound.		
Diseases and fungous injury.	Free from, such as scab, sooty fungus, cedar rust, etc.	Practically free from, such as scab, sooty fungus, cedar rust, etc.	Practically free from, such as scab, sooty fungus, cedar rust, etc.	
Insect injuries, .	Free from, such as result from codling moth, scale, curculio, etc.	Practically free from, such as result from codling moth, scale, curculio, etc.	Practically free from, such as result from codling moth, scale, curculio, etc.	
Bruises and other mechanical injuries.	Free from, except those resulting from packing.	Practically free from, except those resulting from packing.	Practically free from defects that materially injure the appearance or useful quality.	

	"Fancy."	"A."	"B."	Ungraded.
How packed, .	Properly, in clean, strong packages. The fruit should be properly stemmed and tailed. The specimens should be packed firmly but not bruised. That the quality may be maintained, it is desirable that a flexible cushion be placed between the face and the cover. New barrels are preferable. Clean second-hand barrels will answer but they detract from the appearance of the fruit. Packages should be strong enough to prevent mechanical injury to the fruit in handling.	Properly.	Properly.	
Tolerance, .	Apples, on any one defect, or on a combination of defects, may be not more than 3 per cent. below specifications.	Apples, on any one defect, or on a combination of defects, may be not more than 5 per cent. below specifications.	Apples, on any one defect, or on a combination of defects, may be not more than 10 per cent. below specifications.	

Color in the Three Grades.

Regulation. — Color shall refer to amount and not to shade.

The color of apples branded "Massachusetts Standard Fancy Grade" shall cover at least 75 per cent. of the surface in the case of red varieties, such as Baldwin, Tompkins King, Esopus Spitzenburg, Jonathan, McIntosh, Ben Davis, Sutton, Alexander, Wealthy, Fameuse, and the like; at least 60 per cent. in the case of varieties having slightly less red color than the above, such as Hubbardston, Gravenstein, Northern Spy, Rome, Oldenburg, Wagener, and the like; and at least 10 per cent. in the case of varieties having still less red color, such as Maiden Blush, Winter Banana, and the like. Yellow or green varieties, such as Rhode Island Greening, Grimes Golden, Yellow Newtown, and the like, must have the characteristic green or yellow color of the variety; the presence or absence of a blush need not be considered.

The color of apples branded "Massachusetts Standard A Grade" shall cover at least 35 per cent. of the surface in the case of red varieties, such as Baldwin, Tompkins King, Esopus Spitzenburg, Jonathan, McIntosh, Ben Davis, Sutton, Alexander, Wealthy, Fameuse, and the like; at least 20 per cent. in the case of varieties having slightly less red color than the above, such as Hubbardston, Gravenstein, Northern Spy, Rome, Oldenburg, Wagener, and the like; and at least 5 per cent in the case of varieties having still less red color, such as Maiden Blush, Winter Banana, and the like. In the case of yellow or green varieties, the presence or absence of color need not be considered.

The presence or absence of color in the case of apples branded "Massachusetts Standard B Grade" need not be considered.

Minimum Sizes in the "Massachusetts Standard Fancy Grade."

Regulation. — The minimum sizes of apples sold as apples of "Massachusetts Standard Fancy Grade," when measured at right angles to the stem and blossom end, shall be as follows, for the several varieties: —

First Group: Diameter, $2\frac{1}{2}$ inches; Golden Russet, Red Canada, Roxbury Russet, Williams, Yellow Transparent.

Second Group: Diameter, $2\frac{3}{4}$ inches; Baldwin, Ben Davis, Hubbardston, McIntosh, Oldenburg, Palmer Greening, Red Astrachan, Sutton, Wagener, Wealthy, Yellow Belleflower.

Third Group: Diameter, 3 inches; Fall Pippin, Gravenstein, King, Northern Spy, Rhode Island Greening, Rolfe, Rome Beauty.

Fourth Group: Diameter, $3\frac{1}{4}$ inches; Twenty Ounce, Wolfe River.

Marks required on Closed Packages.

Statement in a conspicuous place on the outside of the package in plain letters (not less than 36 point Gothic) of the —

1. **Place**: name of State in which the apples were grown.
2. **Grade**: true name.

Regulation. — The grade of apples contained in a package shall be indicated by the term "MASSACHUSETTS STANDARD FANCY GRADE," "MASSACHUSETTS STANDARD A GRADE," "MASSACHUSETTS STANDARD B GRADE," or "UNGRADED," as the case may be.

3. **Size**: minimum size in all grades. In the "Massachusetts Standard Fancy Grade" the minimum size must be not less than that specified in the regulations (see above). The abbreviation "Min." may be used for the word "minimum." Minimum sizes shall be stated in variations of one-quarter of an inch, such as 2 inches, $2\frac{1}{4}$ inches, $2\frac{1}{2}$ inches, $2\frac{3}{4}$ inches, 3 inches, $3\frac{1}{4}$ inches, and so forth, in accordance with the facts. Minimum sizes may be designated by figures instead of words.

4. **Contents**: *Barrel,* — quantity expressed by the term, "ONE STANDARD BARREL," or by a statement of the measure (the Massachusetts standard bushel of apples sold at retail is 48 pounds), or of the weight in pounds. Pending the formulation by the two departments of regulations with regard to branding, the term "ONE STANDARD BARREL," or the abbreviation "ONE ST'D. BBL.," will be acceptable to the United States Department of Agriculture and the Massachusetts Department of Weights and Measures as a proper and sufficient statement of the contents of a barrel, regardless of whether it is sold at wholesale or retail in intrastate, interstate or foreign commerce. The abovesaid term will be considered also as applying to the barrel itself. *Box,* — quantity expressed in terms of measure, weight or numerical count. In interstate commerce the marking to show merely the number of apples in a box is not sufficient; the minimum size of the apples must also be given (Opinion No. 61, Secretary of Agriculture, Washington, District of Columbia).

5. **Variety**: true name, that is, the name by which the variety is known on the market. Commercial abbreviations may be used. If not known the expression "VARIETY UNKNOWN" may be used.

6. **Packer**: name and address of, or of person by whose authority the apples were packed or repacked. If repacked the package shall be so marked. (Name and address of farm will comply with this requirement.)

Order of Statements on Barrels.

Regulation. — The statements required by the law, and by the regulations adopted thereunder, shall appear on one end of the barrel in the following order: —

1. Name of the State in which the apples were grown.
2. Grade.
3. Minimum size.
4. Quantity of contents.
5. Variety.
6. Name and address of packer or repacker.

Regulation. — The word "MASSACHUSETTS" as used on packages containing apples grown in Massachusetts shall be considered as showing the State in which said apples were grown as well as applying to the grade.

Marking of Closed Packages.

Color of Ink to be used.

Regulation. — All letters and figures relating to grade or brand, including private marks, used in marking or branding a closed package packed in accordance with the provisions of the law shall be in ink of one color.

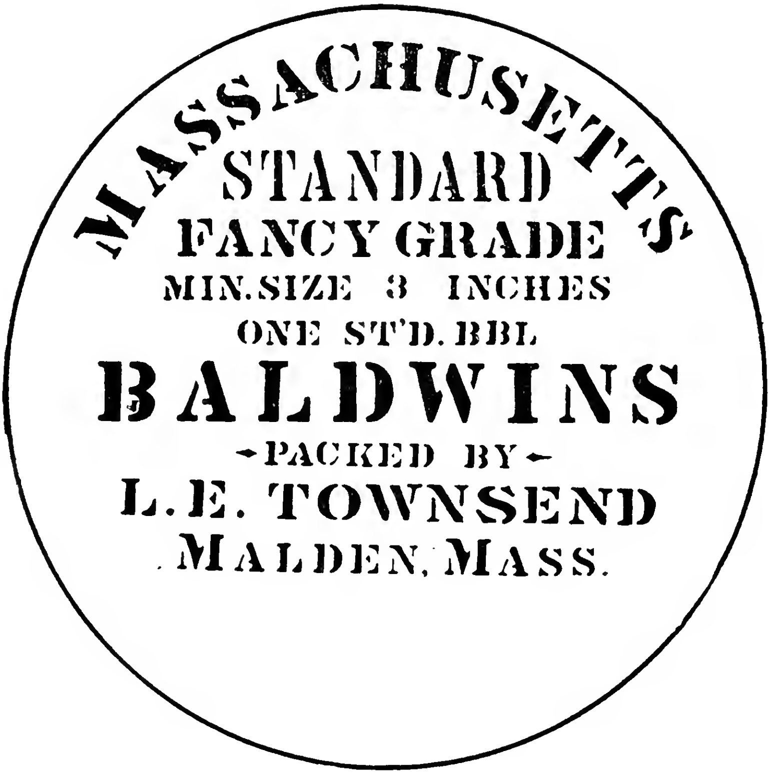
Barrels.

Only block letters and block figures of a size not less than

36 POINT GOTHIC

(one-half an inch high) may be used in stating on the outside the information required.

The following is a reduction of a photograph of a well-balanced barrel stencil. Notice that space is left at the bottom for name and address of consignee.



Another style of stencil is illustrated below. With the exception of the words "PACKED BY," the letters, before reduction, were all 36 point Gothic. This allows more space for other marks, but does not in any way alter the provision that such other marks as refer to grade or brand must *not* be more conspicuous than the marks required by law.

Packages Other than Barrels: How Branded.

Regulation. — The branding or marking of closed packages other than barrels shall be in letters and figures of such a size that the statements required by sections 4 and 5 of the act and by the regulations shall, when properly spaced, cover at least one-half the outside of one end of the package or at least one-half the label affixed thereto.

This is illustrated by the following: —

MASSACHUSETTS
STANDARD
FANCY GRADE
MIN. SIZE 3 INCHES
COUNT 100
BALDWINS
Packed by
L. E. TOWNSEND
MALDEN, MASS.

Other Marks.

The packer or distributor may put any marks on the package other than those required by law, provided, however, that such marks as relate to grade or brand are not inconsistent with, or more conspicuous than, the required marks. This gives an opportunity for the grower or packer to affix his own brand, or name of farm, and facts concerning the quality or other characteristics of the apples.

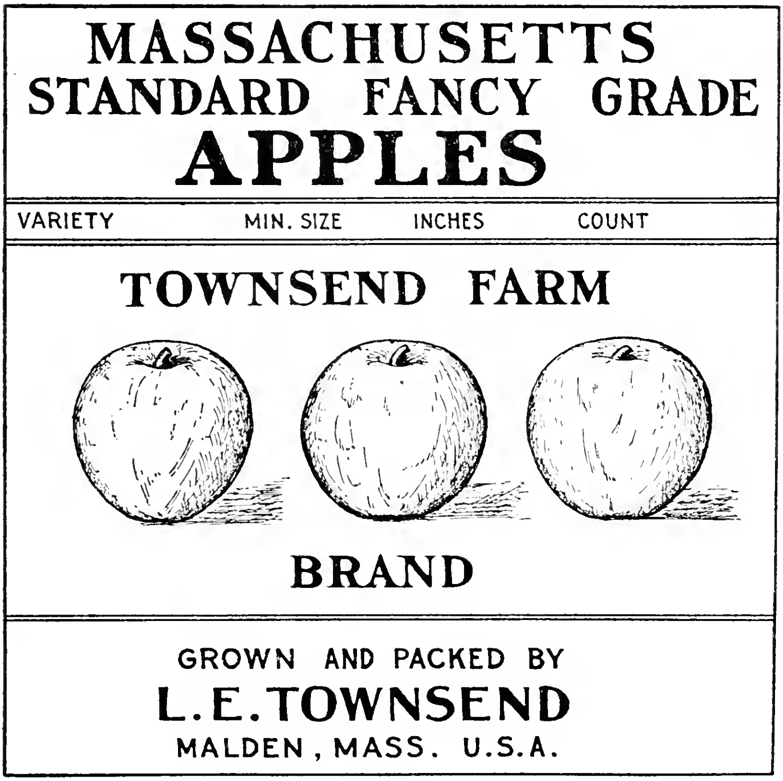
In the case of the type of label illustrated below, the brand is subordinated to the grade. The words "Townsend Farm," however, might be as conspicuous as the words "Massachusetts Standard Fancy Grade," but should not be more conspicuous. The name of the variety might be substituted for the word "Apples," and the label would then read, for example, "Townsend Farm Baldwins."

MASSACHUSETTS
STANDARD FANCY GRADE
TOWNSEND FARM
APPLES

GROWN AND PACKED BY
L.E.TOWNSEND
MALDEN, MASS. U.S.A.

VARIETY MIN. SIZE INCHES COUNT

The label below again illustrates the provision that the required marks must cover at least one-half the label. In other words, more than one-half the label must not be used for private marks. Any design or trade-mark may be inserted with or without the farm name or brand.



Regulation. — Such marks as "No. 1's," "No. 2's," "XX," "XXX," "Extra," and the like shall not be used on closed packages.

Approval of Stencils and Labels.

For the purpose of guarding growers and packers against the incurrence of unnecessary expense on their part it is recommended that before having stencils cut or labels printed there be submitted in duplicate to the secretary of the State Board of Agriculture, for his approval, a sketch, drawing or proof of the proposed stencil or label. One copy will be returned, the other filed.

May be Graded and Branded otherwise.

Regulation. — Apples packed or repacked within the State in closed packages may be graded and branded in accordance with the provisions of the United States Apple Grading Law only when they are intended for shipment to another State or to a foreign country; unless so graded and branded, they shall conform to the requirements of the Massachusetts Apple Grading Law.

POSTER.

Write Wilfrid Wheeler, Secretary, Massachusetts State Board of Agriculture, 136 State House, Boston, for a poster for your packing house or shed, showing the main requirements of the Apple Grading Law.

Appendix.

UNITED STATES STANDARD BARREL LAW.

[Public — No. 307 — 63d Congress.]
[H. R. 4899.]

An Act to fix the Standard Barrel for Fruits, Vegetables, and Other Dry Commodities.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the standard barrel for fruits, vegetables, and other dry commodities other than cranberries shall be of the following dimensions when measured without distention of its parts: Length of stave, twenty-eight and one-half inches; diameter of heads, seventeen and one-eighth inches; distance between heads, twenty-six inches; circumference of bulge, sixty-four inches, outside measurement; and the thickness of staves not greater than four-tenths of an inch: *Provided,* That any barrel of a different form having a capacity of seven thousand and fifty-six cubic inches shall be a standard barrel. The standard barrel for cranberries shall be of the following dimensions when measured without distention of its parts: Length of staves, twenty-eight and one-half inches; diameter of head, sixteen and one-fourth inches; distance between heads, twenty-five and one-fourth inches; circumference of bulge, fifty-eight and one-half inches, outside measurement; and the thickness of staves not greater than four-tenths of an inch.

Section 2. That it shall be unlawful to sell, offer, or expose for sale in any State, Territory, or the District of Columbia, or to ship from any State, Territory, or the District of Columbia to any other State, Territory, or the District of Columbia or to a foreign country, a barrel containing fruits or vegetables or any other dry commodity of less capacity than the standard barrels defined in the first section of this Act, or subdivisions thereof known as the third, half, and three-quarters barrel, and any person guilty of a willful violation of any of the provisions of this Act shall be deemed guilty of a misdemeanor and be liable to a fine not to exceed $500, or imprisonment not to exceed six months, in the court of the United States having jurisdiction. *Provided, however,* That no barrel shall be deemed below standard within the meaning of this Act when shipped to any foreign country and constructed according to the specifications or directions of the foreign purchaser if not constructed in conflict with the laws of the foreign country to which the same is intended to be shipped.

SECTION 3. That reasonable variations shall be permitted and tolerance shall be established by rules and regulations made by the Director of the Bureau of Standards and approved by the Secretary of Commerce. Prosecutions for offenses under this Act may be begun upon complaint of local sealers of weights and measures or other officers of the several States and Territories appointed to enforce the laws of the said States or Territories, respectively, relating to weights and measures: *Provided, however,* That nothing in this Act shall apply to barrels used in packing or shipping commodities sold exclusively by weight or numerical count.

SECTION 4. That this Act shall be in force and effect from and after the first day of July, nineteen hundred and sixteen.

Approved, March 4, 1915.

UNITED STATES APPLE GRADING LAW.

"The Sulzer Bill."

[PUBLIC — NO. 252 — 61ST CONGRESS.]
[H. R. 21480.]

AN ACT TO ESTABLISH A STANDARD BARREL AND STANDARD GRADES FOR APPLES WHEN PACKED IN BARRELS, AND FOR OTHER PURPOSES.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the standard barrel for apples shall be of the following dimensions when measured without distention of its parts: Length of stave, twenty-eight and one-half inches; diameter of head, seventeen and one-eighth inches; distance between heads, twenty-six inches; circumference of bulge, sixty-four inches outside measurement, representing as nearly as possible seven thousand and fifty-six cubic inches: *Provided,* That steel barrels containing the interior dimensions provided for in this section shall be construed as a compliance therewith.

SECTION 2. That the standard grades for apples when packed in barrels which shall be shipped or delivered for shipment in interstate or foreign commerce, or which shall be sold or offered for sale within the District of Columbia or the Territories of the United States shall be as follows: Apples of one variety, which are well-grown specimens, hand picked, of good color for the variety, normal shape, practically free from insect and fungous injury, bruises, and other defects, except such as are necessarily caused in the operation of packing, or apples of one variety which are not more than ten per centum below the foregoing specifications shall be "Standard grade minimum size two and one half inches," if the minimum size of the apples is two and one half inches in transverse diameter; "Standard grade minimum size two and one-fourth inches," if the minimum size of the apples is two and one-fourth inches in transverse diameter; or "Standard grade minimum size two inches," if the minimum size of the apples is two inches in transverse diameter.

SECTION 3. That the barrels in which apples are packed in accordance with the provisions of this Act may be branded in accordance with section two of this Act.

SECTION 4. That all barrels packed with apples shall be deemed to be below standard if the barrel bears any statement, design, or device indicating that the barrel is a standard barrel of apples, as herein defined, and the capacity of the barrel is less than the capacity prescribed by section one of this Act, unless the barrel shall be plainly marked on end and side with words or figures showing the fractional relation which the actual capacity of the barrel bears to the capacity prescribed by section one of this Act. The marking required by this paragraph shall be in block letters of size not less than seventy-two point one inch gothic.

SECTION 5. That barrels packed with apples shall be deemed to be misbranded within the meaning of this act —

First. If the barrel bears any statement, design, or device indicating that the apples contained therein are "Standard" grade and the apples when packed do not conform to the requirements prescribed by section two of this Act.

Second. If the barrel bears any statement, design, or device indicating that the apples contained therein are "Standard" grade and the barrel fails to bear also a statement of the name of the variety, the name of the locality where grown, and the name of the packer or the person by whose authority the apples were packed and the barrel marked.

SECTION 6. That any person, firm or corporation, or association who shall knowingly pack or cause to be packed apples in barrels or who shall knowingly sell or offer for sale such barrels in violation of the provisions of this Act shall be liable to a penalty of one dollar and costs for each such barrel so sold or offered for sale, to be recovered at the suit of the United States in any court of the United States having jurisdiction.

SECTION 7. That this Act shall be in force and effect from and after the first day of July, nineteen hundred and thirteen.

Approved, August 3, 1912.

MASSACHUSETTS APPLE GRADING LAW.

GENERAL ACTS, 1915, CHAPTER 261, AS AMENDED BY CHAPTER 63, GENERAL ACTS, 1916.

AN ACT RELATIVE TO THE PACKING, GRADING AND SALE OF APPLES.

Standard Barrel and Standard Box defined.

SECTION 1. The standard barrel for apples shall be of the following dimensions when measured without distention of its parts: — length of stave, twenty-eight and one half inches; diameter of heads, seventeen and one eighth inches; distance between heads, twenty-six inches; circumference of bulge, sixty-four inches, outside measurement; and the thickness of staves not greater than four tenths of an inch: *provided*, that any barrel of a different form having a capacity of seven thousand and fifty-six cubic inches shall be a standard barrel.

The standard box for apples shall be of the following dimensions by inside measurement: eighteen inches by eleven and one half inches by ten and one half inches, without distention of its parts, and having a capacity of not less than two thousand one hundred seventy-three and one half cubic inches.

Grades defined.

SECTION 2. The standard grades of apples when packed or repacked in closed packages within this commonwealth shall be as follows: — "Massachusetts Standard Fancy" shall include only apples of one variety which are well matured specimens, hand-picked, above medium color for the variety, normal shape, of good and reasonably uniform size, sound, free from disease, insect and fungus injury, bruises and any other defects except such as are necessarily caused in the operation of packing, and shall be packed properly in clean, strong packages: *provided*, that apples of one variety which are not more than three per cent below the foregoing specifications may be graded as "Massachusetts Standard Fancy".

"Massachusetts Standard A" shall include only apples of one variety which are well matured specimens, properly packed, of medium color for the variety, normal shape, sound, practically free from disease, insect and fungus injury, bruises and other defects except such as are necessarily caused in the operation of packing: *provided*, that apples of one variety which are not more than five per cent below the foregoing specifications may be graded as "Massachusetts Standard A".

"Massachusetts Standard B" shall include only apples of one variety, which are well matured, properly packed, practically normal shape, practically free from disease, insect and fungus injury or any other defect that materially injures the appearance or useful quality of the apples, and which may be less than medium color for the variety: *provided*, that apples of one variety which are not more than ten per cent below the foregoing specifications may be graded as "Massachusetts Standard B".

"Ungraded". Apples not conforming to the foregoing specifications of grade, or, if conforming, not branded in accordance therewith, shall be classed as ungraded and so branded.

Use of Other Marks permitted.

SECTION 3. The marks indicating the grade, as above prescribed, may be accompanied by any other designation of grade or brand if such designation is not inconsistent with, or marked more conspicuously on the package than, the mark or marks required by section five of this act.

Minimum Size to be marked on Package.

SECTION 4. The minimum size of the fruit in all grades, including the ungraded, shall be marked upon the package, and shall be determined by taking the transverse diameter of the smallest fruit in the package at right angles to the stem and blossom end. Minimum sizes shall be stated in variations of one quarter of an inch, such as two inches, two and one quarter inches, two and one half inches, two and three quarters inches, three inches, three and one quarter inches, and so forth, in accordance with the facts. Minimum sizes may be designated by figures instead of words. The word "minimum" may be designated by using the abbreviation "min."

Closed Packages to be Branded.

SECTION 5. Every closed package of apples packed or repacked in the commonwealth and intended for sale, either within or without the commonwealth, shall have marked in a conspicuous place on the outside of the package in plain letters a statement of the quantity of the contents, the name and address of the packer or of the person by whose authority the apples were packed, the true name of the variety and the grade and the minimum size of the apples contained therein, in accordance with the provisions of sections two, three and four of this act, and the name of the state in which they were grown. If the true name of the variety is not known to the packer or other person by whose authority the apples are packed, the statement shall include the words "variety unknown", and if the name of the state in which the apples were grown is not known, this fact shall also be set forth in the statement. If apples are repacked, the package shall be marked "repacked", and shall bear the name and address of the repacker, or the name and address of the person by whose authority it is repacked, in place of that of the original packer.

Style and Size of Letters and Figures fixed.

SECTION 6. The branding or marking of barrels under the provisions of this act shall be in block letters and figures of a size not less than thirty-six point Gothic. The secretary of the state board of agriculture shall prescribe rules and regulations as to the lettering to be used in branding or marking other closed packages.

Packing, Sale or Distribution of Adulterated or Misbranded Apples prohibited.

SECTION 7. It shall be unlawful for any person to pack, sell, distribute or offer or expose for sale or distribution, apples which are adulterated or misbranded within the meaning of this act.

"Adulterated" defined.

SECTION 8. For the purposes of this act, apples packed in a closed package shall be deemed to be adulterated if their measure, quality or grade does not conform in every particular to the brand or mark upon or affixed to the package, or if the faced or shown surface gives a false representation of the contents of the package.

"Misbranded" defined.

SECTION 9. For the purposes of this act, apples packed in a closed package shall be deemed to be misbranded: —

First. If the package is packed or repacked in the commonwealth and fails to bear all statements required by sections two, three, four and five and in accordance with the provisions of section six of this act.

Second. If the package, whether packed or repacked within or without the commonwealth is falsely branded, or bears any statement, design or device, regarding the apples contained therein, which is false or misleading, or if the package bears any statement, design or device indicating that the apples contained therein are of a specified Massachusetts standard grade, and said apples, when packed or repacked, do not conform to the requirements prescribed by this act for such grade.

Cold-storage Apples to be inspected.

SECTION 10. Apples which have been in cold storage shall not be sold or distributed, or offered or exposed for sale or distribution, in closed packages until they have been inspected in accordance with rules and regulations to be prescribed by the secretary of the state board of agriculture.

Rules and Regulations to be made.

SECTION 11. The secretary of the state board of agriculture shall make rules and regulations for carrying out the provisions of this act, and he shall publish, on or before the first day of September following the passage of this act, and after a public hearing, rules for the grading and packing of apples and specifying, for each variety of apples, the minimum size which shall be included in the grade designated as "fancy"; and he may thereafter modify such rules and regulations.

Inspectors authorized to enter Places and open Packages.

SECTION 12. The secretary of the state board of agriculture, in person or by deputy, shall have free access at all reasonable hours to any building or other place where apples are packed, stored, sold, or offered or exposed for sale. He shall also have power in person or by deputy to open any box, barrel, or other container, and may, upon tendering the market price, take samples therefrom.

Appropriation provided.

SECTION 13. For the purpose of carrying out the provisions of this act there may be expended during the present fiscal year a sum not exceeding one thousand dollars, and thereafter such annual expenses as may be necessary shall be paid from the annual appropriation for disseminating useful information.

Penalty fixed.

SECTION 14. Any person who adulterates or misbrands apples within the meaning of this act, or who packs, repacks, sells, distributes, or offers or exposes for sale or distribution, apples in violation of any provision of this act, or who wilfully alters, effaces or removes, or causes to be altered, effaced or removed, wholly or partly, any brands or marks required to be put upon any closed package under the provisions of this act, shall be punished by a fine not exceeding fifty dollars for the first offence, and by a fine not exceeding one hundred dollars for each subsequent offence.

Certain Persons exempted and Liability placed.

SECTION 15. No person who sells or distributes or offers or exposes for sale or distribution apples adulterated or misbranded within the meaning of this act shall be deemed to have violated any of the provisions of this act, if it shall appear that he acted in good faith solely as a distributor, or if he shall furnish a guaranty signed by the person from whom he received the apples, with the address of such person, that the apples are not adulterated or misbranded within the meaning of this act. In such case, the person from whom the distributor received the apples shall be liable for the acts of the distributor who relied upon his guaranty, to the same extent as the distributor would have been liable under the provisions of this act.

"Person" and "Closed Package" defined.

SECTION 16. The word "person", as used in this act shall include persons, firms, corporations, societies and associations, and the acts of agents and employees shall be construed to be the acts of their principals and employers as well as of the agents and employees. The words "closed package" shall mean a barrel, box or other container the contents of which cannot be sufficiently seen for purposes of inspection without opening the container.

The act took effect upon its passage, except that the provisions of sections one, two, three, four, five, six, seven, eight, nine, ten, fourteen, fifteen and sixteen were not operative until the first day of July, in the year nineteen hundred and sixteen.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 51.

August, 1915.

TOBACCO GROWING

IN THE

CONNECTICUT RIVER VALLEY.

LESLIE R. SMITH.

FROM THE SIXTY-THIRD ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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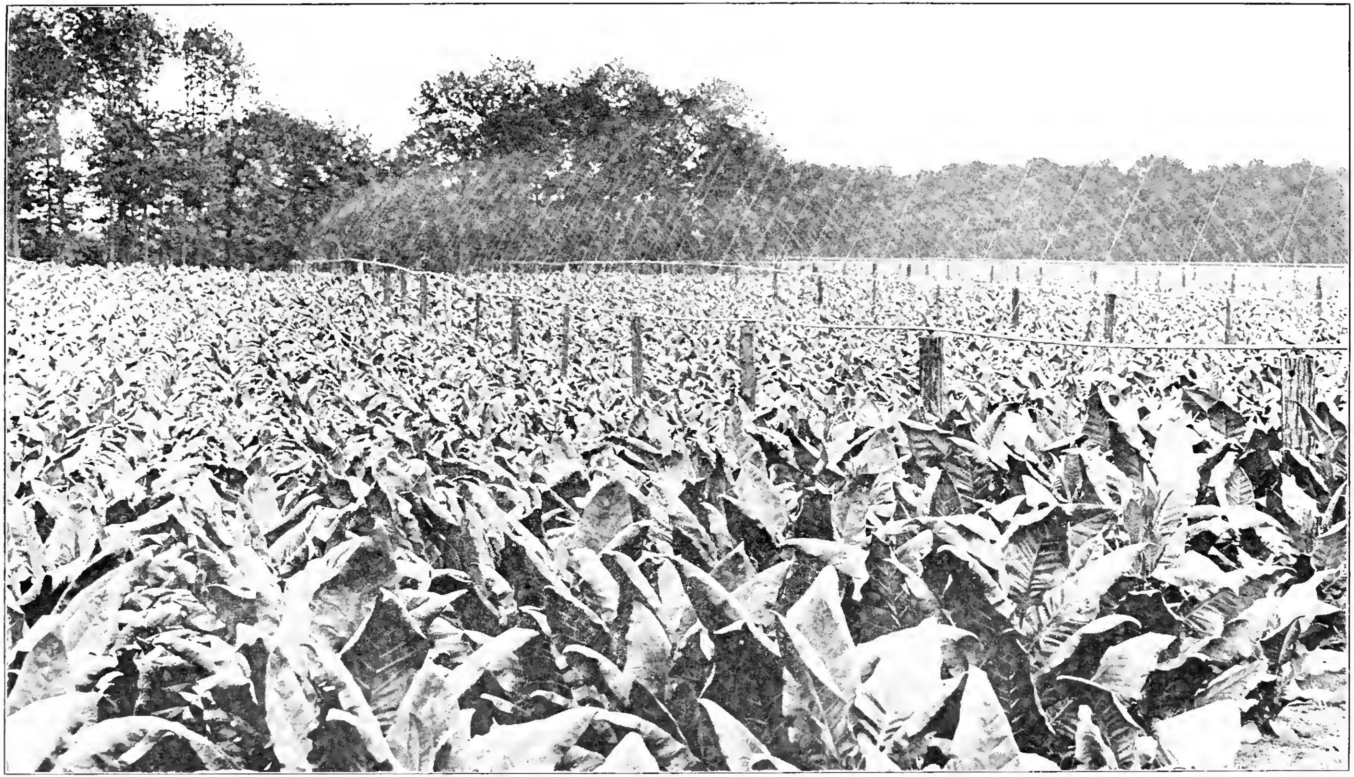
INTRODUCTORY NOTE.

According to the latest census reports the Connecticut river towns in Massachusetts produce about a million and a half dollars worth of tobacco annually. As the last definite enumeration was the Federal Census of 1910, which reported the 1909 crop, these figures are now six years old. The increase since that year has been steady, and it is safe to say that the annual value of the crop in this State at present is not far from $2,000,000.

The tobacco towns of Massachusetts are entirely in Franklin, Hampshire and Hampden counties. By the latest available figures Hatfield is the banner tobacco town of the State, with a production valued at $301,204; Hadley, second, $192,258; and then come Agawam, Whately, Deerfield, Southwick, Westfield and Sunderland in the order named. Hatfield alone has 17 tobacco storehouses, and 425 freight cars are needed to ship the tobacco crop from this one town.



Irrigation system on tobacco field, Hatfield, Massachusetts.

TOBACCO GROWING IN THE CONNECTICUT RIVER VALLEY.

LESLIE R. SMITH, HADLEY, MASSACHUSETTS.

Tobacco has been grown in the Connecticut valley since about 1840, and while the crop has had its ups and downs it may be said to have steadily increased in acreage since that time. The past fifteen years have seen by far the greatest percentage of increase, and the end is not yet. Every grower is growing all the tobacco that he can hang in his curing sheds, and so new sheds are the very best indication of an increase in acreage. The increase of 1915 over the 1914 acreage was around 25 per cent. This crop is by far the most important money crop grown in this section, and represents extensive and intensive agriculture of the highest order.

The rapid increase of the past fifteen or twenty years may be explained by improved machinery, more abundant help, and, most important of all, the fact that in recent years the crop has brought prices that enable the grower to make expenses and have something left over for his labor and as a profit for his operations.

The successful tobacco grower is a specialist, as no crop grown calls for more scientific knowledge or the application of more common sense. In the growing, harvesting and curing of the crop the grower has to know something of practical chemistry, physics and biology.

But after all is said and done, the weather is the dominant factor. The history of the good or poor tobacco crop tells the story of the weather, — as in 1893 when the crop was largely a failure on account of drought, and in 1897 again a failure on account of excessive rain. Late frosts in the spring, early frost in the fall, the hail and windstorms, periods of excessive moisture or too dry weather at curing time, all show how the grower must depend upon nature for his ultimate success. Indeed from the time the seed bed is sown until the end of the season the only time that the grower is sure of his success is when he gets the money for his crop. Yet he is optimistic; he "nurtures hope," he raises his crop, doing all he knows how, and if appearances count for anything he is getting along perhaps as well or better than the average business man.

There is no ironclad rule to be laid down for raising tobacco. The best growers often change their methods and are constantly on the lookout to learn of new ideas that will prove beneficial, so that the story of tobacco growing as told in this article will not attempt to tell of any best way, but will describe the methods as practiced by the most progressive growers.

The Seed Bed.

Tobacco is raised on the same land year after year. Most growers plow or harrow the land immediately after the harvest, thus avoiding a useless second crop of suckers that grow from the stump and remove a good deal of plant food from the soil. Many believe that if the field is kept fallow during the late fall and winter it will not attract the moth that lays the egg of the cutworm, a pest that is the cause of much trouble. The land is left fallow until the next year's crop is set out. This period is a convenient one in which to apply lime.

Each year finds the grower paying more and more attention to the seed bed, there being perhaps no one thing that gives him as much satisfaction in the spring as a good bed. Operations begin in the fall, the grower selecting a place for his bed sheltered from the cold north and west winds. Sometimes it may be necessary to build a board fence for this purpose. Many apply the fertilizer at this time and harrow it in. This is considered the better way if cottonseed meal is used, and some of the best growers say that there is nothing better. In the spring as soon as the ground is dry enough to work the beds are "made." This operation consists of fitting the land, putting up a frame and sowing the seed. Beds used to be covered with brush, but this material has been superseded by cloth and glass, glass being by far the better. The sash are 3 by 6, 3 by 9 or 3 by 11 feet, to suit the grower. These glass beds have enabled the grower of to-day to transplant or "set" tobacco from three to four weeks earlier than from the brush-covered beds of years ago. In "making" the bed the land is made as fine as possible with harrows and rollers, and last with a hand rake. The seed is sown by some growers at the rate of one teaspoonful to the square rod; others sow one tablespoonful to the square rod. After being run through a cleaning machine to blow out the dirt and light seeds the clean seed is usually mixed with plaster, ashes or fertilizer so as to get an even stand. After sowing, the bed is either raked lightly, rolled with a hand roller or simply wet down with a hose; then the cloth or glass is put on. Some sow the seed dry, while others sprout it first.

There are two varieties of tobacco raised in the valley, — Havana seed and Seed Leaf or Broad Leaf. The former is by far the most common in the Massachusetts part of the valley, only a comparatively few raising the Broad Leaf.

After the plants are up every known method is used to force them. The bed may be sprinkled with manure water, or with water which has had ammonia added at the rate of one teaspoonful to the gallon, or water with nitrate of soda dissolved in it. Another method is to sow fertilizer before watering. Dry ground fish is a good material for this purpose as it does not injure the young plants and it is quickly available. Great care should be taken of the bed, especially a glass bed. Often a fine bed is ruined because the owner did not raise his sash on a hot day; again, lack of air also causes "damping off," a disease in which the plant decays just above ground. Sterilizing the ground with live steam in the fall or spring is growing in favor as this not only kills all fungous diseases, but the weed seeds as well. A large square pan of galvanized iron, boards or other material is inverted over the bed. This is pushed down into the soil, after which live steam is turned under the pan and held at a pressure of 80 pounds for half an hour, when the pan is moved to a new place. An objection to the wood box is that it becomes heavy after being soaked with steam. One pan made of galvanized iron 6 by 12 feet cost a grower $22. This grower claims that his beds were steamed at a cost of about $1 per square rod. He grows about 30 acres and started to steam his beds in the fall, but was compelled to give up the operation on account of freezing and finish in the spring. This grower advocates steaming in the fall, as fuel is saved by the ground not being cold, and there is no frost to thaw out. Many growers claim that this steaming will pay for itself simply in the saving of weeds.

Fertilizing the Crop.

Materials used to fertilize the crop are barnyard manure, city stable manure, tobacco stalks, tobacco stems and commercial fertilizers of many kinds. Barnyard manure is not extensively used because it is not to be had. However, if used it should be plowed under either in the fall or spring. A great deal of city stable manure is bought. Tobacco stems are used to some extent, but the quantity is limited. Quite a number of growers are plowing under their tobacco stalks which have been found to contain from 6 to 8 per cent. potash. At a tobacco meeting held during the winter of 1915 one of the speakers asked how many growers present plowed under their stalks, and about one-half of those present replied in the affirmative. This well illustrates the attitude of the grower.

The bulk of the valley crop is raised on chemical fertilizer, and nearly every fertilizer company makes one or more special brands for this crop. Neither all the good nor all the poor tobacco is raised on one particular brand. Years of experience have taught the grower to be particular about the goods he uses. The materials must be quickly available as the crop must ripen in from sixty to eighty days from setting. The fertilizer also has considerable effect on those desirable qualities known as "body," "finish" and "burn." Cottonseed meal is the favorite source of nitrogen. Other ammoniates used are linseed meal, dry ground fish and castor pomace. Bone of some sort is well liked as the source of phosphoric acid, and sulphate is the favorite potash, muriate being tabooed on account of the chlorine contents which affect the "burn."

With a coat of manure 1 ton of fertilizer per acre will raise a good crop, but where manure is not available $1\frac{1}{2}$ to 2 tons of the high-grade goods are often used, the idea being to have enough plant food to insure a good growth. After the land is plowed, harrowed and rolled the fertilizer is applied broadcast. For this operation the fertilizer machine is invaluable, especially in windy weather. No time or expense should be

Cutting tobacco and hauling it to the curing shed, Hatfield, Massachusetts.

Priming shade-grown tobacco.

spared in properly fitting the tobacco land, filling in furrows, if there are any, and using the most efficient tools to pulverize and level the land.

Setting.

Transplanting or setting the plants generally begins about the 20th of May, and is the order of the day until the crop is well started, usually a month later. Setting is almost wholly done with a machine called the tobacco setter, and this is by far the most valuable machine used in the business. The old back-breaking method of hand setting has almost entirely disappeared from the valley. The setter needs plants that are a little larger than for hand setting, but does the ridging, setting, watering and marking for the next row at one operation. This machine requires three men and a pair of horses, and can easily set two acres in an afternoon, while in an all-day session three to five acres can be set, depending on conditions. Tobacco is usually set with the rows 3 feet apart, and the plants from 15 to 20 inches apart in the row. Plants that do not live should be reset at once by hand if an even stand is to be had.

Cultivation.

As soon as the plants have started cultivation begins. A favorite tool for the first time is a 12-tooth cultivator, which by careful handling will allow the operator to work close to the row, the machine being run twice in each row. If deep cultivation is to be practiced, the early part of the season is the time to do it, before the root system has developed. Hand hoeing is next in order, and from now on as long as a horse can travel between the rows the land should be stirred once a week or even oftener. Some growers hoe by hand three or four times in a season, while others use the horse hoe. Many different methods are used, but the principle is the same, namely, to keep the soil well stirred so as to retain moisture and to keep the plant growing all the time.

Topping and Suckering.

When the plant has grown large enough for the seed bud to appear, the top is broken off, or the plant is "topped," the idea being to throw the strength that would naturally go into the small top leaves, blossom and seed into the larger leaves left on the stalk. These are usually from 18 to 22 in number. After the field is topped it presents a very even appearance. In a week or ten days after "topping" suckers will appear, starting from the base of the three or four top leaves. These are picked off, or the plant is "top suckered." After these top suckers are taken off the leaves further down the stalk will begin to throw out suckers, and these in turn must be picked off. Usually when the bottom suckers are grown or are big enough to take off the plant will be nearly or quite ripe and ready to harvest. This will be about three weeks from "topping." The crop should be allowed to get ripe, a condition which is shown by the plant having a slightly wilted appearance, especially on the bottom leaves. Light green blotches will also show all over the top leaves. There can be no doubt that some crops are cut too green, the result being a dark-colored crop that will not bring the best prices.

Harvesting.

There are three methods of harvesting in vogue in the valley to-day. The first two to be described have been in practice for years; the third is a new method that is gaining in favor each year. The first is "hanging on lath." The plants are cut close to the ground with a thin-bladed hatchet made for the purpose. They are then laid down lengthwise of the row and overlapping each other; after lying in the sun long enough to wilt they are picked up and handed to the "stringer" who strings them on a lath. These laths are similar to builders' laths, being sawed a little thicker and from better lumber. One end is placed in a "stringing horse" and the other end is fitted to a steel needle. The plant is then strung on the lath by forcing the needle through the butt of the stalk about 6 or 8 inches from the end, 5 or 6 plants being strung on a lath. The full lath is either laid on the ground and later picked up, or handed directly to a wagon fitted with a rack made for the purpose. It is then drawn to the curing shed and hung on poles, arranged so that each end of the lath rests on a pole, allowing the tobacco to hang downward. Poles are usually 15 feet long and from 25 to 30 laths are hung on a pole. They begin at the top of the shed and are hung tier after tier until the shed is full, the tiers being usually 5 feet high.

"Hanging on string" is another well-known method of harvesting, and many growers favor it above all others. The plants are cut as before, only they are laid crossways of the row, and after being allowed to wilt are loaded directly onto low wagons, the butts laid all one way. The plants are then drawn into the shed where they are hung on poles with tobacco twine. The hanger carries a bag on his back which holds a ball of twine. With this he hangs the plants about 8 inches apart on the poles by tying a half hitch around each plant. When the pole is full the twine is tied around the last plant, broken off and the next pole started.

Priming.

This new method of harvesting tobacco came with the shade-grown tobacco, and has found favor among many growers who grow the outside or sun-grown tobacco. The barn has to be rigged differently, with the tiers only half as far apart as either of the methods previously described. The plant is not cut, but the leaves are picked off or "primed," as they ripen, four or five at a time, beginning with the bottom one. The pickers sit down between the two rows and "prime" both rows, placing the leaves in little piles. These are picked up by another man and placed in baskets and are drawn to the end of the row on a hand truck, loaded onto a wagon, and taken to the shed where the leaves are strung. Generally women and children do this work, using large needles and stringing forty leaves on a string, which has been knotted at one end. After the leaves are all on, the stringer knots the other end of the string and hangs it on a lath which has been notched at either end. These laths are then hung up tier upon tier as aforesaid. In a few days the second priming is taken and so on until the crop is harvested. Cases have been known where the first priming has become cured and taken down before the last priming was taken, thus giving a chance to use the shed a second time in the same season. When the crop is to be primed it is not necessary to top the plant. After the priming is finished the stalks are cut down and utilized in different ways; some growers run them through a cutting machine and plow them under or use them for top-dressing grass.

Curing.

The curing shed is really the factor limiting the increase of tobacco acreage. It is useless for the grower to set more plants than he has shed room to take care of. To hang an acre of tobacco requires a shed 30 by 30 feet. A building this size will cost from $300 up, depending upon whether it is of frame or of pole construction. The pole shed is built by setting the posts in the ground and is not framed, the braces being nailed on. This type of shed is by far the most common. The frame shed is built so that every third board is a door for ventilating purposes.

With the crop in the barn the grower has to watch it closely, opening the ventilating doors on some days and closing them on others; at all times there should be a man near at hand to note the changes in the weather and to act accordingly. With tons of water in the crop which must evaporate in a few weeks this is an anxious time for the grower. Too much moisture will retard evaporation; then, too, there is danger of "pole sweat," while a dry season with the doors open all the time will dry and not cure the crop.

Taking Down.

With the crop cured the next step is to take it down. The tobacco has now changed from a heavy green leaf to a light thin brown, and is so dry that it will crumble if grasped by the hand. To get the crop down whole, therefore, it has to be handled at a damp time, when the leaf is said to be in "case" or, more commonly, "in good shape." "As soft as a kid glove" is an expression often used in describing this condition. When this warm, damp spell comes, no matter if in the middle of the night or on Sunday, the grower gets very busy with all the help he can command and takes down all he can handle. With the lath method the laths are simply slipped off the pole, and with a man on each tier are handed very carefully and quickly to the floor. There the tobacco is pulled off the lath and piled with the butts laid both ways, making a pile about

6 feet wide and as high as the weather will allow. Early in the fall the pile cannot be made as high as later, because the stalks are green and there is more danger of the pile heating.

When hung on string a man at each end of the pole pushes the tobacco into a bunch in the middle of the pole. One man with a sharp knife then cuts the string, the other man handing the bundle to the man lower down, when it is piled as before. With the primed tobacco it is simply slipped off the string and placed at once into a bundle. After the pile is made it must be at once covered so as to retain the moisture. Different materials are used for this purpose, such as damp cornstalks, paper, cloth, etc. From now on the crop must be kept damp, and the shed should be shut as tight as possible to keep out the wind.

Stripping.

As soon as possible after the tobacco is taken down "stripping" begins. With the hands on either side of the pile a section is uncovered, each plant is taken up, and the leaves rapidly picked off or "stripped" one at a time. The stripper begins at the butt, and when finished piles the stumps behind him. The leaves are placed in the stripping boxes which are of different sizes, 36 inches long and 12 inches square being about the average. The box is made with three sides and the ends tight, with saw calves on the side for the string. First the string is placed in the box, then paper of the right size. After the box is full the paper is brought over the top, the string is tied and the bundle taken out of the box. The bundles are piled up from three to five high and the crop is then ready for delivery. The grower has to deliver the crop to the place agreed upon at time of sale, either to a warehouse or a railroad station. Some of the crops are bought in the field before they are harvested, but the majority of the tobacco is sold, and nearly all is delivered to the sorting shops in the bundle. The sorting, packing and sweating is done by the dealer in most cases, and there are the best of reasons for this, as from twenty to thirty varieties are made from the crop and one single grower would have only a little of each variety.

The sorting shop of to-day is a good example of specializing. Here the dealer will grade and pack to suit his trade, making light, medium and dark wrappers, with three to five sizes of each; binders, top leaves and fillers, with different sizes of each. These different grades are packed into boxes $2\frac{1}{2}$ feet square and of different lengths. From 300 to 375 pounds are packed and pressed into a case, which usually goes directly to the sweatroom. This sweating process used to be done in nature's good time, and was accomplished during the hot summer months, the tobacco being dry and ready for market in the fall. Now, however, the crop is forced to sweat by placing it in a steam-heated room with the thermometer at 130 degrees. In about thirty days the operation is complete, and the goods are ready for market. The sorting shops employ a great deal of help during the winter and pay good wages. They usually open about November 1 and run well into April, closing in time to let their men out for outdoor work.

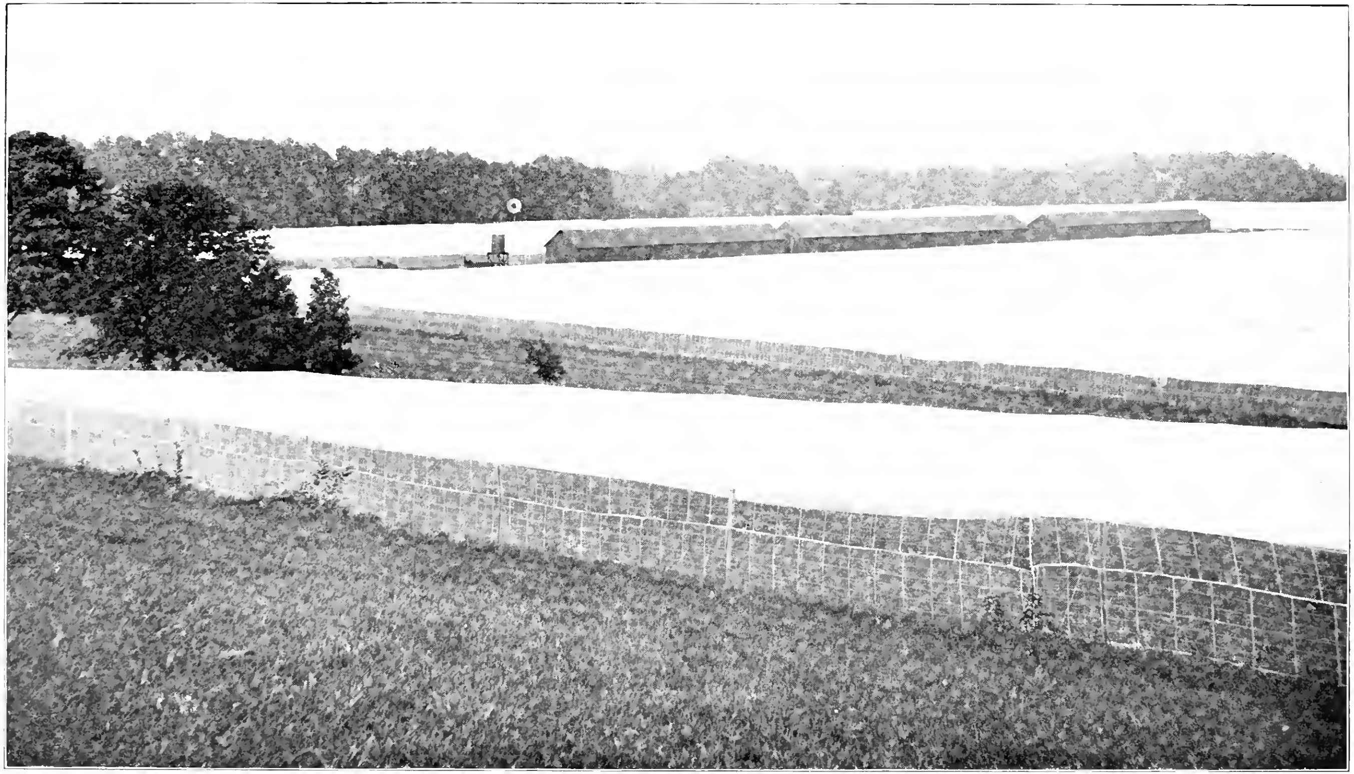
Shade-grown Tobacco.

This article would not be complete without describing in a measure the latest thing in growing tobacco in the valley. To get a cigar wrapper that would possess the qualities of the domestic leaf and yet be thin enough to compete with the goods grown in the tropics the experiment of growing tobacco under shade was tried first in 1900. To-day this process seems to have passed the experimental stage and has evidently come to stay. Many growers are growing from 20 to 50 acres under cloth, while the larger corporations are growing from 100 to 300 acres.

The entire field is set with posts with wire strung across the top. This framework is then covered with cheesecloth, making a vast tent. The plants are set as before described, then the sides are covered so that the cloth reaches to the ground. This tent tobacco is not topped, and often the blossoms will reach the cloth 9 feet from the ground. The tobacco is cultivated by the same methods as outside tobacco, and is harvested by the priming method.

Enemies.

The first real trouble with tobacco is the fungus in the seed bed, and the steaming process already described is the remedy, in the opinion of many growers.



A field of shade-grown tobacco, showing curing sheds in background.

Cutworm.

Immediately after the plants are set the cutworm begins to operate and is at times a serious enemy, not only causing a lot of resetting, but, what is worse, causing an uneven crop of tobacco that will not ripe evenly. A good remedy is a poisoned mash made by mixing a pound of Paris green with a hundred pounds of bran; this should be sweetened lightly with cheap molasses, using water enough to make a stiff paste, and a very little should be dropped beside each plant. This may be done by hand at no great trouble or expense, or by a machine made for the purpose and attached to the setter. Another way is to mix 1 pound of Paris green with 50 pounds of red dog flour, sifting a little on each plant. This is done with a home-made sifter and is not an expensive operation.

Wireworms.

Sometimes, and especially in a cold, wet season the wire-worm causes considerable trouble for the tobacco growers. While the plant is small the worm will bore directly into the heart of the stalk, and the plant will have the appearance of being alive, yet will be dying all the time. The only remedy is late plowing which not only kills the worm but will destroy many of its egg cells.

Horn Worm.

Early in July there will appear on the tobacco plant a small green worm hatched from an egg about the size of the head of a pin. This egg is laid by a moth that flies only at nightfall. The worm will grow as large as a man's finger, and as it grows will eat more and more ravenously. One worm will often spoil two or three plants. Hand picking is the only remedy practiced in the valley.

Grasshopper.

The ordinary grasshopper will cause trouble occasionally, especially if the field is next to a grass lot. After the grass is cut, if the weather is dry and the rowen crop does not readily start, the hopper will eat the leaves of the plant next to the grass full of little round holes. Some growers protect their field by planting two or three rows of corn between the tobacco and the grass.

Hail and Wind.

The elements mean real trouble for the grower, as hail and wind may quickly ruin his crop. Insurance is possible at a cost of $7.50 per acre. A policy of $150 per acre for a total loss will about pay for the cost of the crop.

Early Frost.

The remedy for this is to have the crop under cover before the frost comes.

Pole Sweat.

Pole sweat is caused by a spell of damp, warm weather during curing time, when the atmosphere is so damp that evaporation cannot take place. It may be controlled by the use of charcoal fires built in the shed, either in holes dug in the dirt floor or in small furnaces made for the purpose.

These are a few of the troubles that keep the tobacco grower guessing the whole season long. Other problems will only be settled as time brings the answer. One question that is causing much discussion is the supply of humus. Without manure there is a danger of the soil being without vegetable humus, and as a result it packs down too hard and does not retain moisture as it should. Some growers are using a cover crop, sown as soon as the tobacco crop is harvested and plowed under early in the spring. This plan is being tried out more and more, the claim being made that not only does the cover crop supply a certain amount of humus, but that it also keeps the soil from washing and blowing during the late fall and winter months. Barley, vetch and rye are the crops usually sown.

Just a few last words on the subject of "handling." The idea of tobacco growing is to make money. In order to get the best price for his goods the grower must raise good tobacco. He must handle it right after he has raised it. Many a crop is spoiled in harvesting. The leaves should be kept free from holes, sunburn, bruises, etc., all of which can be avoided by proper handling. The grower is mistaken when he thinks he can save money by using boy or cheap help, as a slovenly, careless man may easily spoil more tobacco in a day than he is worth. The dealer will many times buy tobacco before it is harvested if he knows that the grower is a good handler and that he will put up his crop right. Another grower gets the name of being a "hog handler," as it is called. Dealers say that he handles his tobacco just as he does his cornstalks; thus, as in other things, it is true of tobacco raising that "whatever is worth doing at all is worth doing well."

Estimate of Cost of raising One Acre of Tobacco.

Rent of land (including use of shed),	$50
Labor (including raising plants),	70
Fertilizer,	50 to $80
If bed is steamed,	2
Paper and twine,	2
	$174 to $204

Estimate of yield for past five years,	1,500 pounds
Estimate of price for past five years,	15 cents

This is the average, but it is true that many growers get from 1,700 to 2,000 per acre and from 15 to 20 cents per pound.

Cost of Shade-grown Tobacco.

According to the figures obtainable it costs around 45 cents per pound to raise shade-grown, and it has been sold at 90 cents per pound. The yield per acre has been around 1,400 pounds.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 52.

August, 1915.

ONION GROWING IN THE CONNECTICUT RIVER VALLEY.

LESLIE R. SMITH.

FROM THE SIXTY-THIRD ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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INTRODUCTORY NOTE.

Next to potatoes and green corn the onion crop has the largest value of any vegetable crop in Massachusetts, the last State census giving this crop an annual value of $662,000. The two leading counties in onion production as with tobacco are Hampshire and Franklin, in the order named. Hampden County, the southernmost of the Connecticut River counties, however, does not rank high in this crop. The distribution of the onion crop over the State is much wider than with tobacco, and Essex, Middlesex, Bristol and Worcester counties all raise appreciable quantities. The towns of Arlington and Belmont, in particular, both raise considerable quantities.

Hatfield and Sunderland are the two leading towns in onion growing and are followed by Hadley, Deerfield and Whately. Probably the principal reason for the preponderance of onion growing in the Connecticut valley is the ease with which the land there can be worked on account of its level and comparatively stoneless nature. The crop is fairly adaptable, however, and farmers who have any flat land of a muck nature would do well to try onions on it in a small way.

Onion Growing in the Connecticut Valley.

LESLIE R. SMITH, HADLEY, MASSACHUSETTS.

In the past twenty years onion growing in the Connecticut valley has grown from almost nothing to a money crop second in importance only to tobacco. Acres that were formerly given up to grass, corn and other general farm crops are now taken up with this crop, which is successful both on the heavier and lighter soils of the valley. The abundant Polish help is probably the one largest factor in bringing this about, and the fact that onions can be grown with very little capital has given many of these hard-working people a start toward prosperity. The Polish are raising nearly all the onions in the valley to-day, either on shares, by the acre, or on their own farms. Other factors which have combined to make the crop very much of a success are the ease with which the valley can be worked by modern farm machinery, on account of its level nature and freedom from stones; the system of storage houses that has become a necessity to the handling of the crop; nearness to the large market centers; and first-class shipping facilities.

Without any great fanfare of trumpets, a system of co-operation has grown up here in the onion business, very practical and very successful, which enables the man who owns the land to do a profitable business only limited by the number of acres that he has suitable for onion raising. This is what makes it possible for an honest, industrious man without a cent of capital to go into business for himself and to get a start toward a home. This has happened here in the valley time and time again.

A farmer may have forty acres of onions being grown by a dozen or more different men, each absolutely independent of the other. By one plan the farmer will furnish the land and the fertilizer, sometimes the team work and one-half the seed;

the grower will do all the hand labor, harvesting, etc., and each have one-half of the proceeds. By another plan a farmer may contract with the grower to do the work for a stated sum per acre, and the grower contracts to take care of from two to five acres, according to the size of his family, for in the onion business "every one works, father not excepted." Each plan is in common practice, and there are arguments in favor of both.

With the "share system" the grower is as much interested in the success of the crop as the owner, and will work as hard to keep the land clean from weeds and do everything in his power to get the crop early, in order to receive the highest price at market time and incidentally to make a reputation for himself as a good grower. A successful grower is in good demand and can get his pick of the onion fields. With the other plan, the grower is sure of his price per acre, as the owner takes all the risk, and of course all the profits if such there be. In either case a contract is drawn up signed by both parties which specifies just what each party agrees to do. This contract gives the owner permission to enter upon the premises at such time or times as he may see fit to inspect the crop of onions, and, if at any time the grower shall fail to perform all the labor necessary to raise the crop, gives the owner the privilege of doing or furnishing such work and labor as shall be necessary to raise and protect the crop until the time of sale, and the grower agrees to pay to the owner such sums as this shall be reasonably worth. These contracts are nearly always fulfilled. Once in a while a crop does not look well when it comes up on account of poor seed, or for some other reason, and the grower will throw up his contract, and in so doing forfeits what work he has already done. Cases have occurred where, after the grower had given up his contract, the owner has hired the same party to care for the crop at so much per acre, and has made more money than he would had the grower held to his agreement.

Growing the Crop.

After the owner has planned how many acres of onions he will let out next year he will get busy in the fall, plow his land, and if possible apply lime if his soil needs liming. The

Irrigation system on onion farm, Hatfield, Massachusetts.

onion crop is sown just as soon as the land is dry enough to work in the spring, and so this fall work is essential. In the spring every horse is at a premium, and a team with driver has received $7.50 a day at this time. If, however, lime has not been applied in the fall and is to be applied, then it is the first job in the spring and should be followed by the wheel or cutaway harrow, and right here is a good time to say that extra team labor expended at this time will be time and money saved later in hand hoeing and weeding. Team work is far cheaper than hand work, and this is true of any crop: a deep-plowed, well-fitted soil is an asset all the season through, especially in case of drought.

The plow that has become the most popular is the sulky, because the dead furrow is obviated, which is a great advantage in the onion field. The harrows used are mostly the wheel or cutaway, the Acme and the Meeker smoothing harrow. After the field is thoroughly wheel-harrowed the fertilizer is applied with a fertilizer distributor, a machine universally used. This machine is not only a labor-saver, but allows fertilizer to be applied on a windy day, when hand work would be out of the question.

Fertilizer: Kind and Amount.

The onion field has to be enriched by the use of commercial fertilizer. Barnyard manure is seldom used because of the weed seeds which it carries, as this material in the soil would interfere in a measure with the use of the wheel hoes and hand cultivators, and last because the onion grower does not have it to use; so it is a question of commercial fertilizer. Opinions, both with regard to the brand and the amount of fertilizer, are as varied as there are different growers. A grower is very apt to try again the brand that has raised him one good crop, or that has raised his neighbor a good crop. There are growers who buy the chemicals and mix their own fertilizer, but others, and probably the majority, buy ready-mixed goods. Both methods are in vogue and there are arguments in favor of each. An analysis of 3.30 nitrogen, 8 phosphoric acid, 7 potash (actual) is about the popular goods used in the valley, and nearly all the fertilizer companies make a brand of this or similar analysis. Hundreds of carloads are used annually in the onion section.

The growers all know that there must be no shortage of plant food for the crop. The up-to-date farmer understands that his overhead charges are fixed, that is, he has to stand the expense of plowing, fitting, cultivating and harvesting; that the cost is about the same whether an average crop is grown or a bumper crop, and that up to a certain point the profit increases with the increased yield; so it is a vital error of judgment to hazard chances of a profit by being "pennywise and pound foolish" in skimping the fertilizer. The Connecticut valley grower sows one and one-half tons of fertilizer to the acre, and is not at all backward about putting on an extra half ton if he thinks that it is necessary. This is usually applied at one time, but some large growers are trying the experiment of keeping one-half ton to apply in mid-season.

After the fertilizer is applied there is probably no better tool to use in harrowing it in than the Acme harrow, and after all is done that can be done with this or similar tools there is nothing that will put on the finishing touch and leave the land in as nice a condition for sowing the seed as the Meeker smoothing harrow. This implement was born with the onion industry and increases in popularity yearly.

Sowing of the Seed.

Good seed is important, so important that fortunate indeed is the grower who (regardless of price) has purchased a really first-class seed. Southport Globe is the variety most commonly used, and the growers are very particular in regard to it, often purchasing subject to a germination test at the Massachusetts Agricultural College, and in a great many cases having the seed "blown" at the college. This process consists in running the seed through a machine with a bellows attachment that will blow the dirt and the small light seeds out. The amount varies from 5 to 6 pounds per acre. Either of these amounts would be too much if every seed matured, but all do not sprout; the onion maggot gets some, and more are cut out from time to time in the process of hoeing and weeding throughout the season. The rows are sown either 12 or 14 inches apart, and there are a number of seeding machines on the market, both single and double row, that do satisfactory work.

Cultivation.

As soon as the rows can be seen the hoe is started, either the wheel or the common scuffle hoe. One will often see hoes of three or four makes working in the same field and all doing good work, as much more depends on the man than the hoe that he uses. From this time until the crop is drawn away the fields are alive from dawn until dark with men, women and children. Many growers put up a little shanty which serves as a shelter on hot days for the hands to eat their lunch in and to keep the tools in at night.

The lesson has been well learned that onions and weeds do not get along well together, and the good grower knows that he must weed early and often to keep the field clean. Fields that have grown onions for years, or "old fields," as they are called, will be easily kept clean with three or four weedings during the season. New fields will require more attention, the crop needing to be hoed from six to ten times, depending on weeds and weather. After the crop has grown so that wheel hoeing is out of the question the weeds can be taken care of with a common hoe with a handle cut to a length of 6 inches.

When the onions have attained their growth and begin to die down they are "pulled" either by hand or with machine. There is an attachment to the wheel hoe which consists of a curved and sharpened blade that runs under the rows, cutting the roots and throwing the onion out of the ground, and this does good work if the field is free from weeds.

The onions are allowed to lie for a few days to let the tops cure, then "clipping" begins. This operation means the handling of each onion and clipping the top off with the onion shears. In the west machines do this work, but as yet they have not been received with favor in the valley. After clipping, the onions should not be allowed to lie on the ground too long, especially during rainy weather, as this will cause the outer skin to crack open, leaving the onion green, and interfering with the selling and keeping quality. The better way is to shovel them into old fertilizer bags with a wire scoop; from these they can be readily dumped into the screen. Screens of different sizes are used, varying in mesh from $1\frac{1}{8}$ to $1\frac{1}{2}$ inches. Running over these screens the onions are sorted into No. 1's and picklers. Incidentally this cleans and improves the looks of the crop. From the screens the onions are put into bags holding 100 pounds net and sewed up, and are then ready for shipment. The practice of putting the crop into new and uniform bags is gaining in favor, especially at the market end of the business.

Marketing.

The bulk of the onion crop is sold to a buyer in the fall; indeed, if the grower has not storage he must either sell the crop or rent storage. The system of storage houses that has grown up in the valley within a few years is the direct result of necessity. The old practice of dumping the whole crop of valley-grown onions on the market as soon as ready was disastrous, as it simply meant glutting the market and unsettling market prices to a marked degree. Whether to sell or to hold in storage is a question for every grower to settle for himself, as his own circumstances will be the determining factor. One prominent grower and dealer made this statement this winter, "that in a period covering ten years the grower who sold in the fall would make fully as much money as the man who held in storage." There is the cost of handling, storage and shrinking to take into consideration, and as before stated each grower will have to decide the question for himself. The buyer stores the onions and then supplies the market as fast as the demand appears.

Troubles.

Yes, the onion grower has them, and some years there are plenty. Perhaps the first thing that troubles the grower and causes him to lose sleep is the high wind that comes each spring through April and May. This is especially dangerous for the man who is raising onions on light land, as the wind will in some cases blow the seed from the ground, and every year finds some fields resown for this reason. The only remedy for this trouble is irrigation, of which more will be said later.

Next, the onion maggot has the floor, and as yet no remedy for this pest has appeared. The eggs of this insect are laid by the onion fly on the outside of the plant close down to the earth; the eggs hatch and the young maggot directly eats his way into the heart of the plant. The first sign of trouble

Digging and sacking onions, Hatfield, Massachusetts.

the grower has is when the onions begin to die, and on pulling them up he finds the maggot, sometimes four or five in a single stock. A little extra heavy seeding and keeping the plants growing as rapidly as possible is about all one can do in this case.

Another serious insect enemy is the thrips, and here the best remedy is irrigation, as this is a dry-weather trouble. The writer has seen a field covered with thrips and looking as though a fire had run over it, while just across the road was a field as green and healthy as one could wish, simply because of irrigation. The thrips is an insect that appears in dry weather and sucks the juice out of the tops of the onions, always starting on the knolls and spreading very rapidly. In practically every instance the crop will stop growing at whatever stage it happens to be.

On some old fields a disease known as smut has appeared and caused trouble. One partial remedy is to use formaldehyde diluted 1 gallon to 50 of water and applied at the time of sowing the seed. A 2-gallon tank is attached to the seed sower with a small hose or lead pipe running down under it and running a small stream of the mixture directly into the seed.

Irrigation.

Up and down the valley are different growers who are experimenting with irrigation on the onion fields, and so far reports are favorable. This will obviate the trouble of the seed and fertilizer blowing off in the spring, and is believed to be a remedy for the thrips; but most important of all is the fact that the grower who irrigates can control the supply of moisture and so increase his crop. The system used is the overhead one, and the cost of installation will range from $150 to $200 per acre, depending on the area and the amount of labor that the grower can do or furnish. Instances will be found where absolutely reliable men say that the system has paid for itself the first year.

Cost of Growing.

It is comparatively easy to figure the cost of raising native onions. The crop should be charged with whatever equally good land could be rented for; then there is the cost of plowing, fitting, etc., depending on how much time is put on the field. Fertilizing will cost from $50 to $60 per acre, seed from $5 to $12 per acre, hand labor from $65 to $90 per acre, and if there is trouble with smut there is the cost of the formaldehyde. Sacks are usually furnished by the buyer.

A man who understands his business can care for three acres of onions, and if he has a family with children will do more by occasionally hiring a few days' help. As stated before, plenty of our thrifty Polish farmers have made their start this way, but they work and work hard, believing that "seed time and harvest will never fail." And in the majority of cases they win out.

Cost of One Acre of Onions.

Rent of land (or interest if land is owned),[1]	$20.00 to	$40.00
Plowing,	2.50 to	3.50
Fitting,	5.00 to	5.00
Fertilizers,	50.00 to	60.00
Seed,	5.00 to	12.00
Labor,	65.00 to	90.00
Formaldehyde,	1.00 to	1.00
	$148.50 to	$211.50

The yield per acre runs from 500 to 1,000 bushels, and the average price to the grower for the past five years (in the fall) has been about 55 cents. From these figures it is apparent that a good-sized crop of onions should yield a good profit to both the owner of the land and the grower.

[1] These figures are based on Connecticut River valley conditions. The item for rent is of course high, but this is because good onion land in this section commands from $400 up to even $800 an acre. A farmer in another section where land was not so valuable would save considerable expense on this item. — EDITOR.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

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POULTRY AND EGG PRODUCTION.

Harry R. Lewis.

From the Sixty-third Annual Report of the Massachusetts State Board of Agriculture.

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POULTRY AND EGG PRODUCTION.

HARRY R. LEWIS, POULTRY HUSBANDMAN, NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS.

It is with extreme pleasure that I have been able to meet with you at these sessions and receive some of the spirit of progress and co-operation which is so very apparent everywhere. I feel especially at home among you, for I not only have met many personal friends, but am, myself, a native of southern New England, having been born and reared on a large poultry and general farm in Rhode Island. While the conditions are somewhat different in New England than they are in New Jersey, yet a careful study of both have convinced me of the fact that the principles underlying the successful management of the flocks are the same. Any slight differences which may be necessary are of application, the method of applying the principle varying with the breed kept, climatic and market conditions. We have, as you know, in New Jersey a State which is noted for its large commercial egg farms, where White Leghorns predominate, and where the white-shelled egg for the New York market is the primary consideration. Here in New England, the larger, heavier, general-purpose breeds, useful for both meat and eggs, have by far the leading advantages. New England is especially fortunate in having not only suitable land and admirable climate, but also unlimited markets, and I firmly believe that with more attention to the farm poultry flocks, with better methods of production, the poultry industry of New England could be made one of its leading and most remunerative branches of agricultural effort. In order to accomplish this there are certain fundamental considerations which must be studied, and I would present the following to you for consideration.

I. Keep Pure-bred Birds of a Well-established Breed.

We hear a great deal these days about utility *versus* fancy, which, analyzed, means the production of eggs and meat *versus* shape and plumage pattern. This agitation about the so-called utility possibilities has doubtless been brought about by the results secured at the egg-laying contests throughout the country, and also by some phenomenal records which have been made by some cross-bred birds. As a general statement it may be said that it is a mistake to attempt to produce eggs or poultry continuously from cross-bred stock. Considered over a period of years, birds which are continuously cross bred produce no characteristics which are not supplied by pure-bred individuals. Cross-bred birds show no reliability in breeding where egg production is the primary object. A larger egg production can be secured from typical egg breeds than can be secured from crosses of the egg and dual type. Where meat production is the object, larger returns both in quality and quantity can be secured where the pure-bred meat breeds are used. The use of standard bred birds, of a well-established variety, results in a uniform flock, both as to general appearance, size, shape and color, and the birds bring a more uniform price on the market than the mixed types. They cost no more to keep than a mongrel or a bird of mixed breed, for they consume no more feed nor do they require any more labor to care for them. Where pure-bred birds are kept, often considerable revenue can be secured from stock and eggs sold for breeding purposes. The additional revenue so secured is almost all clear profit. These factors should be given careful consideration before an attempt is made to produce eggs at a profit from a flock which has been promiscuously cross bred.

Constitutional or inherited vigor is, above everything else, necessary in order that the poultry flock shall succeed continuously. It is the experience of the author that where the stock is weak, poor hatches result, high mortality is common, low egg production and sick birds are the rule. On the other hand, where poultry farms have made marked success it can be traced in almost every instance to sturdy, rugged, healthy, vigorous stock. In discussing the stock there are a number of things to consider. Foremost is the determination of the breed best adapted to produce the type of product required. The birds themselves have frequently been likened to machines, which are required to transform the raw product — feed — into a finished product, — eggs and meat. Without a well-built machine this transformation cannot be carried on at a profit. There are many different types of birds, each designed for the production of a different type of product. The determination of the breed should be the first question decided. Three general classes of birds exist, first, the so-called egg or light breeds, most of which are of Mediterranean origin, of which the Leghorn is the typical example. These birds are kept in large numbers on successful farms where the production of white eggs for the wholesale markets is the primary object. It is an established fact that in New Jersey and New York these white-shelled eggs sell for from 3 to 15 cents more than brown eggs, the average premium being about 5 cents per dozen during the entire year. This difference is not apparent in Boston or southern New England. These light-egg breeds stand the confinement well and admit of herding together in large flocks. They are essentially active and are close feathered. Their rather large fleshy head parts require careful protection against freezing during severe weather in the winter.

The second type of bird may be called the general-purpose, and this includes the Wyandotte, the Rhode Island Reds and the Orpingtons. These breeds are characterized by their ability to lay a goodly number of brown-shelled eggs, and to bring in considerable revenue when sold for market purposes. It is this type of bird which is kept on some of the large commercial farms, but they more especially comprise the popular type on the farm and in the suburban communities. Being largely dual purposed they are the most desirable type for supplying home demands.

The third type of fowl comprises the meat breeds, of which the Brahma and Langshan are examples. These are the largest birds kept in flocks where market poultry products are the primary object, and especially where capons and roasters constitute the main marketable product. Recognizing these three distinct types, the breed should be selected which personally appeals to the poultryman, and which produces the best type or combination of products for his particular object or markets.

II. Make Special Selected Matings for Breeding Purposes.

The aim of every poultry keeper, if he expects to remain in the business, should be to continuously build up his flock by breeding. Where the poultry and egg production is the primary object, the breeding efforts will be along two distinct lines. The first is to develop the most efficient egg machine which it is possible to breed. This means that his birds must be capable of turning out a maximum number of eggs of good quality during the winter season of high prices. This machine must be maintained at the minimum cost for feed and labor. The second object should be to develop a bird for table purposes, which will attain a sufficient weight in the shortest possible time, the flesh being of high quality and put on with the least expenditure for feed, thus securing the greatest possible margin of profit.

Paralleling these two aims in breeding should be the continuous effort to breed for vigor and stamina. I would that there were words in the English language which would enable one to express the great importance of vigorous stock. During the time that one is breeding for the so-called ability or commercial characteristics he should not lose sight of breed characteristics, and by selection and careful mating should improve his birds in respect to the body conformation which is required of that respective breed; and in order to maintain uniformity and an attractive appearance about the farm he should study to fix more permanently a uniform plumage pattern.

These results cannot be accomplished by promiscuous breeding, but they can be secured by continuous selection and the making of small special matings each year, following out a definite scheme of inbreeding and line breeding. A brief discussion of the most available method follows.

None will deny the fact that variations exist in birds, some good and some bad. The power of selection which the poultryman possesses is a wonderful instrument for improvement. The difference in birds is made possible by variation and by a continual selection of those which possess desirable qualities, and propagating these qualities into future individuals. A higher standard of efficiency in the progeny will thus continuously be secured. Careful attention to breeding accomplishes two definite things, — it increases the production of individuals, thereby making it possible to secure higher individual records, and it stimulates the average of the mass through the elimination of poor producers and the substitution of heavy layers in their place.

In order to be able to select and breed intelligently, the poultryman must know what his flock is doing. He must know the flock average in egg production. And what is of even greater importance, he must be willing to trap-nest a small percentage of his birds in order to learn individual performance. Unless he can determine the very best birds, selection and breeding with the idea of improving the average will accomplish little for lack of a basis of selection.

III. Hatch relatively early.

The time of year for hatching chicks which are to be reared as future pullets, or which are to be sold for broilers, should be carefully considered. A few weeks too early or a few weeks too late may mean the difference between a profitable winter production in the case of pullets, or in the case of broilers it may mean the difference between 30 and 50 cents a pound on the market. Late hatched pullets grow slowly during the summer, owing to the fact that they do not get a good start, and hence do not come into maturity in the proper time in the fall, and do not get under way in egg production before winter shuts down. On the other hand, if they are hatched too early, as, for example, early February and March, they will doubtless molt in the late fall, which will cause a lower production during the balance of the winter. The exact time for hatching will be determined largely by the type of bird kept. The

American general-purpose breeds are characterized by slow growth, and hence must be hatched earlier than the light, active Mediterranean breeds which mature in from one month to six weeks' shorter time. The Leghorn and birds of their type are best hatched about the middle of April. Where it is necessary to bring off more than one hatch, they can be safely brought off from April 1 to May 15. This will give them between five and six months in which to mature, and thus be in laying condition by October. Heavier breeds will usually do better if hatched from the middle of March, and not later than the last of April.

The following are some of the more important advantages coming to the poultryman who tries February hatching: —

1. A considerable egg yield is secured during the late summer and fall, when the yearling hens are on strike, due to molt.

2. The eggs produced during these fall months bring high returns when sold for table purposes, due to scarcity.

3. The pullets may be profitably used to produce hatching eggs the following spring. A good number with strong germs and of good size is assured.

4. Cockerels which can later be used for breeding make good size and strong development early in the season.

5. The chicks will make an excellent growth before the hot, dry weather of summer comes on with its retarding effects.

6. Surplus cockerels will sell for high prices as broilers during the early spring.

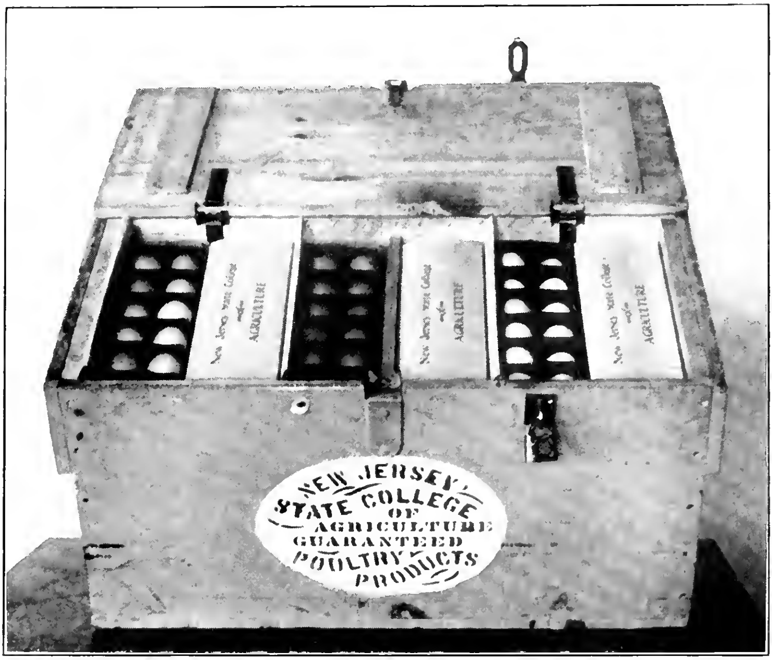
7. The farmer will find early hatching profitable, as he can give them better care at this time than after the rush of spring planting begins.

8. To the commercial poultryman it lengthens his hatching season, and does not compel such intensive concentration as if all the pullets were brought off during one month.

9. The females reach maturity long before the intensely cold weather commences, which means greater vigor and better resistant powers.

10. A greater combined efficiency from all operations if the proper proportion of early hatched birds is kept.

Another factor which affects the time of hatching is the con-



Quality in market eggs means more profit. (Courtesy of the New Jersey Agricultural Experiment Stations.)

dition of the range upon which the chicks are reared and the method of feeding. Youngsters which are provided during the summer with an abundance of range, providing shade and green food and plenty of nutritious food material, will make a more rapid and uniform growth than flocks which are crowded into small bare yards during the same time.

The hatching egg should be carefully selected in order that it may be uniform in shape, size, and, as far as possible, in color; it should also be strictly fresh and of normal shell. If these characteristics are chosen, the tendency is for the progeny to lay a more uniform product.

Experience shows that eggs decrease in their hatching power the longer they are held, and it is never safe to hold hatching eggs over three weeks. When it is necessary to hold them for even a short time they should be placed in a moderately cool temperature, between 40 and 50 degrees being the most desirable. They should also be turned occasionally to keep the air cell from becoming misplaced. If possible, it is well to stand them on the end, leaving the air cell uppermost. The character and quality of the chicks resulting from the hatch will depend in large measure upon the condition of the hatching eggs placed in the machine. Too much care cannot be expended in keeping the eggs in a normal condition.

IV. Practice Constant Selection.

Selection should not only be continuously practiced in mating the breeding flocks, but it should be the plan to eliminate weak or sick birds throughout the brooding, rearing and adult periods whenever they appear. Fowls which show at any time a lack of inherent ability to resist disease are never a profitable animal on the farm.

Constitutional vigor, or, expressed differently, inherent vitality and stamina, is pictured by the perfect health, the activity and the vitality which is seen in strong fowls. Birds showing a lack of these are unsatisfactory, both as producers and reproducers. As we expect more and more of the modern hen in the way of production, fowls often break down, and the effect is especially shown in future progeny. Much of the low vitality and poor hatching quality in eggs, much of the weakness of the brooder chicks, much of the mortality and disease in adult stock can be traced to lowered vitality in ancestors, due in many cases to the immense requirements for production. The average hen is expected to lay in a year from four to five times her body weight in eggs. This means one egg approximately every third day of the year. In order to perform this feat of production she must consume approximately twenty-five to thirty times her body weight in feed. There is, doubtless, no farm animal which is more efficient as a transformer of the raw material into the finished product than the hen. The successful breeding for vigor means the appreciation of two sets of factors, — first, the lack of vitality, and second, signs in an individual which determine the presence or absence of vigor. Valuable work has been done by a number of our experiment stations in studying these factors.

The successful commercial poultryman and the farm poultry keeper who have studied their birds have learned that forcing, due to heavy feeding, or to intensive conditions, if continued year after year, cannot but, in the end, break down the physical strength of birds so treated. They have also observed that inbreeding for a number of generations, without regard for vigor in succeeding generations, intensifies the characteristics of low vitality which the original parents possessed. The use of pullets for breeding purposes, due to their immaturity, cannot but result in progeny of small size and possessed of less than their full quota of stamina. Forced feeding during the winter and fall, especially of concentrated protein feeds, has the immediate effect of taxing the digestive system, causing the bird to go off its feed and lowering its energy and physical strength. The continued crowding of breeding stock into poorly ventilated quarters, and the giving to them an insufficient amount of exercise, is another direct cause of low vitality. Such conditions will be apparent in the fertility and vitality as possessed by the germ in the hatching egg. Lack of care in hatching and improper range conditions for the growing stock are two other common causes of lack of vigor. Probably the greatest of all causes is the failure of the poultryman to select his breeding stock with great care. Breeding from nonvigorous birds means nonvigorous progeny, whereas the breeding from vigorous birds means vigorous progeny. When mating up the breeding pen, select male birds which show signs of physical strength and superiority; for example, the bird with a bright prominent eye, with a well-developed blocky body, with an erect carriage, glossy plumage and bright comb and wattles. The vigorous birds are usually active and spirited in their movements. They range extensively in search of forage. They will be seen to scratch energetically in search of feed. In a great many cases they are the last birds on the perch at night and the first birds off the perch in the morning. In the case of the male, the loudness and frequency of the crow is an indication of physical superiority, while the continual cackle and singing of the female has the same indication. It will be evident to any practical poultryman that there is a very definite and fixed relation which exists between the external appearance of fowls and their vitality; hence it should be the aim to systematically select for constitutional vigor at all ages and for all purposes.

V. Induce a Uniform, Rapid Growth.

A possible serious loss to the poultryman is death in the brooder. This loss can be, in large measure, avoided by selecting a suitable brooding system which will maintain proper environmental conditions, and in addition to this, by providing the chicks with a suitable feed ration. For the small poultryman, brooding only 200 or 300 chicks, the small outdoor brooder of 50 or 60 capacity may be satisfactory, but for the commercial poultry farm, or for the farm flock where 300 chicks and upwards are reared, the so-called colony brooder stove will be found very desirable. These are recent products, having been put on the market within the last two years. A great many different types are available. One which is substantially constructed and has a rather large metal reflector which can be raised and lowered, and which is provided with an accurate, simple method of regulating temperature, should be satisfactory. From 300 to 500 chicks (never over 500) can be placed under one of these hovers, and a brood of from 85 to 95 per cent. should be secured. The commercial plant doing considerable winter brooding, especially where winter broilers are produced, will find that an intensive brooder house, with a central heating plant and pipe running under the hovers, will have certain advantages. The colony brooders seem to be, at the present time, the most economical solution to the brooding problem. They should be placed in a relatively large house, never smaller than 12 by 14 feet, preferably of two rooms, one room containing the heater or hover, in which a fairly warm temperature is maintained, and an adjacent room in which the chicks can be fed and take their exercise. This colony system of brooding allows the chicks from the beginning considerable range, and cuts down the cost in permanent equipment and labor. It also enables the use of the house continuously throughout the year, for after the chicks have gotten old enough to do without heat, the stove can be removed and the house used for a colony house during the growing period, in which the pullets can be left until they attain maturity. During the winter the houses can be used for a short period for special breeding flocks.

The proper feeding of the artificially brooded chick is important, since the digestive system during the first four weeks is very delicate and easily upset by improper feed. The general practice should be to feed the chick the first few weeks of its growth without forcing, allowing to develop a vigorous constitution with a good body growth, and after that time it can better stand forcing for a rapid meat growth when desired.

When planning the rations for the youngsters, and when determining the method of feeding, it is important to ppreciate that the first feeds should be easily seen and should contain much nutriment. It is also well to practice a restricted or retarded early feeding in order that their delicate digestive organs may not be overcrowded. Grit and shell are important essentials in the chick ration, and fresh water should be provided in large amount. Dry, cracked grains are safer, for the first few weeks at least, than wet mashes. Wheat bran is an important addition to the feeding practice, as it contains ash, is slightly laxative and is relished by the birds. Ash in the form of phosphoric acid can be secured in the form of dry ground bone, and is an essential element. During the early part of the feeding period the chicks should be fed little and often, and should be kept busy and hungry between feedings. Sour milk in a loppered condition is very desirable, as it not only furnishes much food material, but the lactic acid present acts as an internal disinfectant. A continuous effort should be made to practice clean feeding, for nothing will upset the digestive system quicker than sour and moldy feed.

Hardening-off Process.

In order to get the chicks in condition for removal to the range it is necessary after the second week to practice a hardening-off process. This should be gradual and consist of lowering the temperature, with the idea of doing away with artificial heat entirely in from three to six weeks, depending upon outside weather conditions. The best practice is to reduce the artificial heat until it can be entirely given up, then gradually to raise the hover until it can be entirely open, and replace with muslin-covered frames, having them hung to the hover wall, gradually raising them in front a little each night until the chicks become used to their absence. It is impracticable to take them from a warm, heated brooder house and put them into a colony house unless they have been accustomed gradually to the change. The idea should be to get them on the range as soon as possible. When they are four weeks of age, the sooner they can be gotten out into the cool temperature in large, well-ventilated quarters, with free range, an abundance of green food and access to the ground, the better they will grow and the hardier and more vigorous will they be at maturity.

This hardening-off process is especially desirable with Leghorns, as their close feathering makes them susceptible to cold weather, and when not properly weaned they pile on top of one another to keep warm. This usually results in the death of many and a loss of vitality to the others.

After the chicks are weaned and placed on the range the aim should be to induce a continuous growth throughout the summer. Any checks or setbacks which they might be subjected to, due to improper feeding or care, will result in irregular maturity and lack of uniformity. There are two factors, aside from their inherited characteristics, which affect proper maturity. These are environmental conditions and food supply.

Environment plays an important part, as the best bred chicks, possessing all other desirable characteristics, if not given ideal conditions in which to grow will not exercise or develop to the fullest extent. These conditions are as follows:—

1. One should not attempt to grow young stock on restricted range.

2. Shade should be provided in abundance.

3. An abundance of green succulent food material is very necessary.

4. The type and size of the house in which the chicks are placed bears a close relation to their growth. Fresh air is the limiting factor.

The method of feeding the growing stock is not complicated. The practice should consist of having the food before them all the time, so that they can balance their own ration. They will usually take sufficient exercise if given plenty of range; hence the common practice is to feed a well-balanced dry mash in large, self-feeding hoppers, and supplement this mash with a good cracked grain ration. A complete dry mash should be used, it being always before them. In addition to this, a ration consisting of equal parts of cracked corn and whole wheat should be fed twice a day about the range.

This method of feeding will allow the chicks to balance their own rations, and will give the weaker ones a constant supply to which they can have access when they are crowded away at the grain-feeding time by the larger ones. Dry mash in self-feeding hoppers will tend to equalize growth and produce a more uniform flock at maturity, while the feeding of cracked grains entirely will tend to exaggerate and constantly increase any difference in size which may exist. Large self-feeding hoppers, holding from 200 to 300 pounds of mash, can be constructed and placed at frequent intervals around the range. This will facilitate the feeding and make the mash available at all times and to all chicks.

VI. Provide a Suitable Environment.

The design of a poultry house and of its construction determines in large measure the environmental conditions which will surround the bird. The modern poultry house must provide all the features necessary to create ideal conditions, for no matter how well a flock of birds may be bred, if the poultry house is damp, drafty, cool and poorly lighted, disease and a decrease in vigor will surely result.

The following are the principles governing the design and construction of a suitable poultry house: —

(*a*) Dryness is fundamental in the poultry house.
(*b*) Plenty of sunlight needed.
(*c*) Importance of thorough ventilation.
(*d*) Give the birds plenty of floor space.
(*e*) Birds must be protected from an excessive cold temperature.
(*f*) The construction of the house must be rat proof and vermin proof.
(*g*) Economy in construction is a first-hand consideration in designing and building the laying house.

With these few words as to the principles of design, the following discussion of the New Jersey multiple unit laying house will give the details necessary to construct an efficient house possessing the features above mentioned.

The New Jersey Multiple Unit Laying House.

The following plan of a shed-roof house, 20 by 40 feet, is especially suited to New Jersey poultry farms. Where it is desirable to keep larger units than a 40-foot house will accommodate, it is recommended that the length be doubled, making it 20 by 80, with three cross partitions (one every 20 feet), instead of only one, as in the 40-foot house.

The following description of the above plan shows the important features: —

The outside dimensions are 20 by 40 feet, sills to be 4 by 6, and to be bolted to a concrete foundation wall 8 inches wide, which is laid on tamped cinder or crushed stone, the entire depth of the foundation trench being 3 feet.

The shed-roof type of construction is used with 9-foot studding in front and 4½-foot studding in back. All studding and rafters are 2 by 4 hemlock or yellow pine. A 2 by 6 girder runs the length of the building supporting the rafters on concrete piers. The plates should be of 2 by 4 material doubled and joints broken.

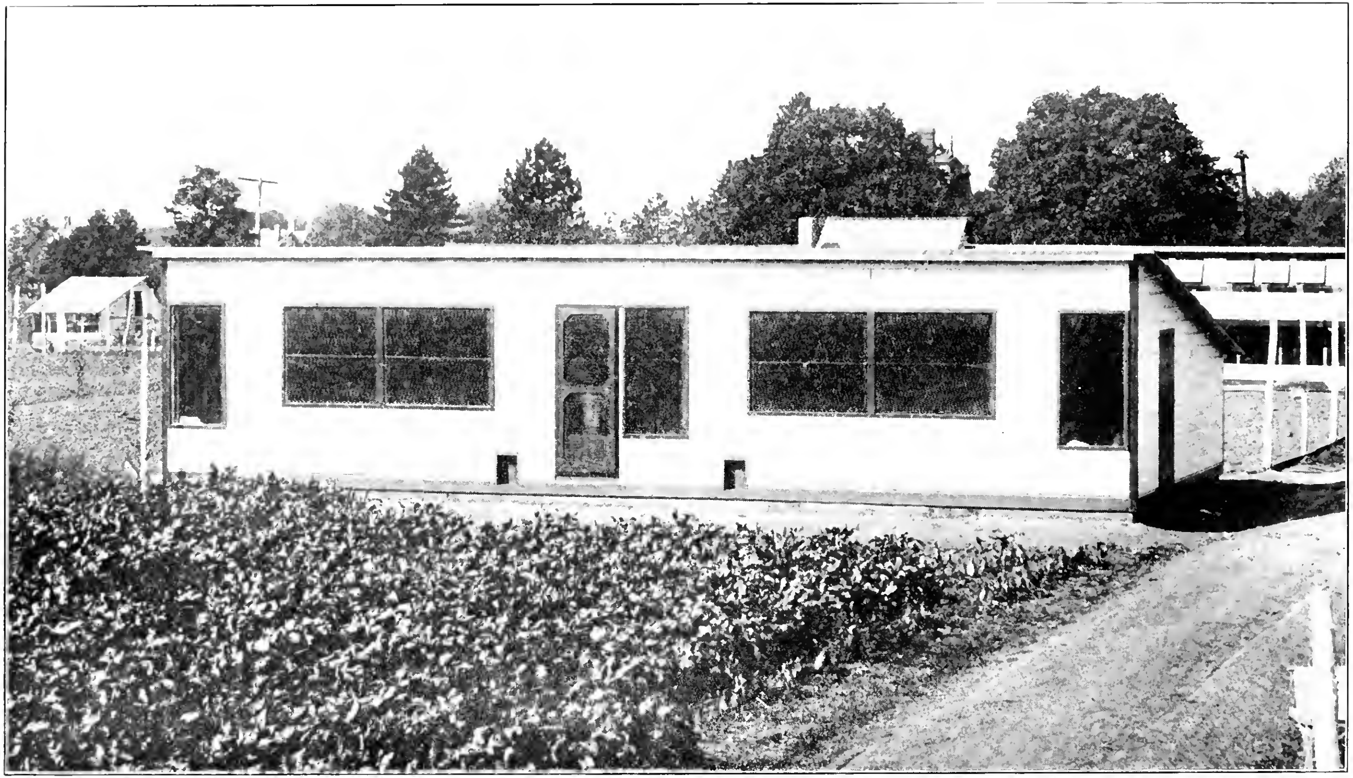
All outside walls and roof should be single boarded, preferably of 8 or 6-inch tongued and grooved yellow pine; white pine can be used, but is much more expensive. The roof and back wall should be covered with a good roofing paper; all joints should be carefully lapped and cemented.

The muslin curtains in the front wall are hinged at the top and can be lifted up. The 3 by 5 glass is hinged at the side and open. One window in each pen should be so constructed that part of the wall will open when desired, thus making a combination door and window. This will greatly facilitate cleaning and filling hoppers, etc., in an extremely long house.

The dropping boards, perches and nests are best arranged on the back wall, the perches being hinged to the wall so that they may be hooked up when cleaning, the nests being darkened by a hinged door in front which may be let down when it is desired to remove the eggs.

The dividing partition between the units is built of boards, and extends from the back wall to within 6 feet of the front wall; the remaining space is left entirely open. This protects the birds from any drafts when on the roosts. When desired, portable light wire partitions may be used to separate the units. A large dry mash hopper should be built into this middle partition. If four or five units are built, it is only necessary to have a hopper in the center of each two units, the other dividing partition being utilized for nesting space. This hopper should be constructed with a wooden cover hinging at the center. There is a slatted elevated platform under the muslin front which provides room or the water fountain and grit and shell hoppers.

When the house is completed, a concrete floor should be laid, and should consist of three distinct layers. First comes a layer of about 6 to 10 inches of cinders or coarse gravel tamped thoroughly to serve for drainage purposes, to keep the soil moisture away from the bottom of the floor. Next comes a rough coat of concrete about 4 inches thick, and over



The New Jersey multiple unit house. (Courtesy of the New Jersey Agricultural Experiment Stations.)

this a finishing coat of two parts of sand to one of cement, troweled smooth and rounded at the corners. Where there is danger of much moisture between the rough and finished coat of cement, level it with a broom before the finish coat is laid.

Such a floor is moisture proof, rat proof, vermin proof and easily and quickly cleaned.

The following is a list of materials which will be required for building a double unit: —

List of Materials required and Approximate Cost.

Lumber: —

Sills, 6 pieces 4 by 6 by 20 feet, hemlock.
Plates, 8 pieces 2 by 4 by 20 feet, hemlock.
Posts, 2 pieces 4 by 4 by 14 feet, hemlock; 2 pieces 4 by 4 by 18 feet, hemlock.
Studding, 9 pieces 2 by 4 by 14 feet, hemlock; 4 pieces 2 by 4 by 14 feet, hemlock.
Rafters, 21 pieces 2 by 4 by 22 feet, hemlock.
Frames for nests and dropping boards, 5 pieces 2 by 3 by 16 feet, hemlock.
Eight-inch tongued and grooved yellow pine boards for roof, dropping boards, walls and nests, 2,200 square feet.
1 by 2 white pine for curtain frames and trim, 200 linear feet.
1 by 4 white pine for nests, 100 linear feet.
One bundle plaster lath for broody coop.

Nails: —

10 pounds 20 penny wire.
50 pounds 10 penny wire.
20 pounds 8 penny wire.

Approximate cost of the above,	$75 54
Roofing paper, 1,060 square feet, or 11 rolls at $3,	$33 00
Four special sash, 3 by 5 feet at $2,	8 00
Muslin, 8 square yards at 20 cents per yard,	1 60
Hardware, as hinges, locks, tacks, hooks, wire, etc.,	4 75
Foundation and floor: —	
Cement, 35 bags at 50 cents,	17 50
Cinders or gravel, 30 yards at $1,	30 00
Sand, 5 yards,	7 50
	$102 35
Total cost, not including labor if cement floor is put in the house and cinders and sand have to be purchased,	[1] $177 89

[1] Costs of material for this house will of course vary in different localities and at different seasons. The above are prices current at New Brunswick, New Jersey, in January, 1916.

This gives a cost per square foot of floor space of $0.22.
A cost per running foot of house of $4.44.
A cost per bird, allowing 4 square feet per bird, of $0.888.
Adding labor to this at one-fourth the cost of material, the total cost is $222.36, or $1.11 per bird.

Environment is one of the great factors in production. The essentials of a suitable environment have been outlined. The importance of these factors cannot be too strongly stated. An appreciation of the fact that it is the healthy, contented, well-fed, singing hen that lays at a profit will do much towards insuring success from the beginning.

VII. Practice an Efficient Feeding Practice.

The following is the New Jersey State dry mash with the supplemental rations which are designed for the complete feeding of laying hens throughout the winter. Such modifications as are necessary for summer feeding for different breeds are also described.

Dry Mash.

Kind of Food.	Amount by Weight (Pounds).	Amount by Measure (Quarts).
Wheat bran,	200	380
Wheat middlings,	200	240
Ground oats,	100	100
Corn meal,	100	95
Gluten feed,	100	80
Alfalfa,	100	200
Meat scrap,	200	176
Total,	1,000	1,271

This mash should be kept before the birds all of the time in large self-feeding hoppers. During the molting season in the fall it is desirable to substitute oil meal for the gluten meal in the same proportion, to hasten the growth of feathers. As soon as the birds get on the green grass range the alfalfa can be gradually omitted and the meat scrap slightly reduced in amount. The extent to which the above mash can be cut during the summer will depend upon the character and amount of the range which is allowed the birds.

The mash as given is designed especially for the feeding of Leghorns; when heavier breeds are kept, such as Plymouth Rocks or Wyandottes, especially with yearling or two-year-old hens, the tendency will be for them to take on an excess of fat. Under such conditions it is the best policy to restrict the amount of mash eaten by leaving the hopper open during the afternoon only, thus inducing the birds to work during the morning hours for the cracked grain fed in the litter at the morning feeding.

As a supplemental ration to the dry mash the following grain rations are fed. A scratching ration of whole grain is fed every morning, both winter and summer, about 9 o'clock, in deep litter. Its primary object, aside from its nutritive value, is to induce the birds to take a considerable amount of exercise. About 5 pounds of this scratching ration is fed to each 100 birds on the floor of the house or under some shelter where the litter is dry and where there is protection from cold winds. The scratching ration is made up as follows: —

Scratching Ration.

Kind of Food.	Amount by Weight (Pounds).	Amount by Measure (Quarts).
Wheat,	100	53
Oats,	100	98
Total,	200	151

At 4 to 5 o'clock in the afternoon, depending on the season, a night ration is fed, composed of whole and cracked grains, at the rate of 10 pounds to 100 birds.

Night Ration.

Kind of Food.	Amount by Weight (Pounds).	Amount by Measure (Quarts).
Cracked corn,	200	120
Wheat,	100	53
Oats,	100	98
Buckwheat,	100	66
Total,	500	337

It will be noted that by feeding a night ration as outlined the materials are supplied to keep the bird's body warm during the night. The above ration is designed for Leghorns. When feeding heavier breeds it is desirable to eliminate one-half of the cracked corn and to substitute barley for buckwheat. During the summer months a night ration of equal parts of corn, wheat, oats and barley will supply all the needs for Leghorns. A good rule to follow in feeding the night ration is to give all the birds will eat, and then a little more, so that there will be some left for them to work on in the morning.

One great advantage of the dry-mash method of feeding is the fact that the birds are allowed to balance their individual rations in large measure, according to their particular tastes and requirements. The feeding of some succulent material in addition to the grain rations is very necessary for the best success.

VIII. Market the Products systematically.

Uniformity in all poultry products is essential. Color of egg, shell, size of eggs, size and weight of broilers and roasters are a few instances where uniformity means more returns.

The best of quality is none too good. The best always brings the highest price. Strictly fresh eggs, clean and carefully graded and packed, are always in demand. Infertile eggs for market are always in demand over fertile eggs. We must not be contented with getting a good production, but of equal importance is the necessity of getting good returns due to quality.

Mr. Pierson of Amherst. I would like to ask if you gave your hens all the skim milk they wanted?

Professor Lewis. Yes; if we gave the birds all the skim milk they could eat we would cut our meat scrap down one-half, making the meat scrap 10 instead of 20 per cent. If you can get skim milk, by all means give all you can to the laying hen.

Mr. Pierson. Is it a stimulant?

Professor Lewis. Not quite, but I would feed it if I had it. It has the lactic acid factor, which is a good internal disinfectant. I would prefer sour skim milk to any form of buttermilk I could get.

Mr. PIERSON. You don't get as much of lactic acid in the skim milk?

Professor LEWIS. No, but you get a high protein content which is very desirable; you get a lot of casein which you do not get in buttermilk.

Mr. H. G. WORTH. I would like to ask in feeding mature birds, why you feed cracked corn with your wheat instead of whole corn?

Professor LEWIS. Our idea in feeding our grain ration is to get exercise, as much as anything else. If we feed whole corn, a bird grabs a piece of whole corn and has got the equivalent of six or eight pieces of cracked corn, and it will fill our birds' crops up with much less exercise than cracked corn. Its food value is absolutely the same, but we are strong advocates of cracked corn for that one reason if no other. There are times when whole corn is desirable; in the winter, when it is very cold and we want to give the bird things that will fill it up quickly, we feed whole corn possibly, at noon; otherwise we feed cracked corn.

Mr. WORTH. Would not feeding the cracked corn be more expensive? Wouldn't there be particles of it that the bird would not get, and would not the bird get sufficient exercise in finding the corn without being fed with cracked corn?

Professor LEWIS. We always feed a sifted cracked corn, and there is probably no waste.

QUESTION. In regard to feeding snow, what have you to say in regard to letting poultry eat snow instead of water?

Professor LEWIS. It is our practice, and the practice throughout our section, never to let birds out, that we want to get egg production from, after the first snow falls in the fall, or after the ground gets frozen and muddy. Here is the proposition: birds going out and eating snow, or going out on cold, wet days, get chilled, and it is bound to reduce their production. The chilling seems to retard their reproductive functions and sets them back, and I should be strongly opposed to letting birds out where they could get snow in the winter when I was after egg production. With breeders, where I wanted a full amount of vigor, I would let them run out all winter.

Mr. J. W. SANBORN. What do you think is the best litter?

Professor Lewis. We use for litter, wheat or rye straw, primarily because it is coarser and does not grind up like oat straw. We grow quite a lot of our own litter, — buckwheat straw or oat straw, — harvesting it with the grain or throwing it directly in the pen and letting the birds thresh the grain out. I am an advocate of straw litter, supplemented if possible with shavings; that makes it drier and the shavings absorb the moisture from the droppings. I would say straw first and, if possible, a mixture of shavings.

Mr. Sanborn. How deep would it be safe to have it?

Professor Lewis. Eight or 10 inches. We usually start in the fall with it about 4 inches deep and add to it each week a little coarse litter. Keep the litter deep, coarse, dry and clean. If, due to certain conditions of moisture or a large number of birds closely confined, the litter gets dirty or finely ground, we do not hesitate to clean it out and put in fresh litter.

A Member. Do you use dropping boards?

Professor Lewis. Yes; although it takes a little labor to clean them off it maintains absolutely sanitary conditions, reduces any odor which might come from using dropping pits, and gives the birds the entire floor space. There is an important factor, — if we use pits there is too much floor space taken up. The capacity of the house is really determined by the number of square feet of floor space for the birds; therefore we get the perches up above the ground 3 or 4 feet, cleaning them off twice a week and putting on gypsum to keep them in good condition. Then we keep all the droppings and have a good income from those. We sell them in New Brunswick at $8 to $10 a ton to farmers who grow vegetables for the New York and New Jersey markets.

Mr. A. C. Hawkins. Do you advocate open-front houses in New England?

Professor Lewis. I advocate open-front houses in New Jersey and northern New York, and I know they have succeeded in Maine. I know also that your own professor of poultry husbandry at Amherst recommends them. In New Brunswick we had last winter a temperature of 14 degrees below zero, and 200 Leghorns, in an absolutely open-front house, where the house is dry, went through that cold snap without a frozen comb. Another flock of 100 Rocks and 100 Leghorns, in a house with a solid glass front, where the temperature in the house never went below zero, had their combs frozen and were put entirely out of condition on account of the increased moisture content due to lack of fresh air and ventilation. I believe that birds will stand a very cold temperature, providing the atmospheric conditions are dry. I believe you will find that the freezing of combs is not due so much to cold temperature as it is to cold temperature combined with dampness, or with dampness and poor ventilation, which means that the birds are of low vitality.

Mr. Carver. Do you advocate feeding wet mash?

Professor Lewis. No, except in one or two instances; it requires a good deal more labor, care and knowledge on the part of the feeder, and if that care and knowledge is not present it will put the birds out of condition. Dry mash will produce just as many eggs. There are one or two instances where a wet mash may be desirable, — for pullets coming in off the range in the fall and that have not grown very well possibly a little wet mash, just crumbly, with a little ginger or saltpeter in it, may be desirable; and for yearlings that don't come back so well when the molt is over, a little wet mash with a little tonic in it may be desirable. A lot of our most successful poultrymen feed wet mash and get along with it very well. I am not condemning it, but it requires a personal application and knowledge of the birds and their appetite which few of us possess, and commercially or with a farm flock the same results can be secured with much less labor by the feeding of a dry mash.

Mr. E. C. Barber. If we feed poultry six varieties of grain at one time they will always pick the corn first; is that a sign that it will do them the most good?

Professor Lewis. No, I don't think so. We put some 30 grains and their by-products before a flock of 200 hens for a year; corn was the favorite and barley next. I think they need it, of course, to maintain themselves and provide heat and energy, but wheat is a more evenly balanced ration for poultry than corn, containing, as it does, considerable protein and not as much carbohydrates or fat. Corn is a very desirable feed; it is of a carbohydrate character but has a very small amount of protein, and you cannot make eggs from corn alone.

QUESTION. Would you tell me what is your opinion of feeding green corn, to chickens eight or ten weeks old, on the cob?

Professor LEWIS. I don't know that I ever fed any of it. I don't know why it would not be all right. It is succulent and palatable, and they would probably relish it as a part of their ration. It could not be substituted for dry mash or grains at all, because green corn is primarily a carrier of water, having 70 or 80 per cent of water present. I think there are other sources which would supply succulents in large quantities more economically.

Mr. HAWKINS. I would like to ask if there are any special characteristics by which we can select the hens that are the best layers by their general type and appearance?

Professor LEWIS. You saved me by putting on "appearance" at the end. There are certain factors which a number of investigators have brought to light recently which tend to be correlated with egg production. We have all said that the heavy producers, in the majority of cases, must have deep, long, wide bodies. I do not mean to say that every bird that has a deep, long, wide body is a heavy producer, but that practically all heavy producers have abundance of room in there, just as a good dairy cow has certain well-defined characteristics. There are other factors aside from that, definitely correlated with egg production. One is the color of the shank. Professor Rice has found that the heavy layers laid the color out of their shanks. A pullet will start out in the fall with bright yellow shanks; the color pigment in her shanks and her ear lobes will be utilized in going into egg production; by spring she will have pale shanks and ear lobes. The Connecticut station has done a lot of work on the color of the ear lobe of the cockerel as related to egg production, and there are other characteristics, such as the prominent eye and deep-seated head, which are indicative of vigor.

It is not such an awful proposition to take ten of the best hens picked by their external appearance and put them in a coop and trap-nest them during December, January and February. The birds that lay the most eggs during those months are almost invariably the ones that lay the most eggs during the year, and that is the type of bird you want to propagate. I believe it will pay anybody to separate four or five birds like that and get his wife or daughter or somebody to help him with the trap-nesting. It really only makes one extra trip in the morning, because in April, when they are laying heavily, you have got to visit them often. The only way we are going to improve our poultry and get definite improvements is by knowing what the individuals are doing. The poultryman has to come to it just as the dairymen have come to it.

Mr. H. B. Walter. Do you use a green feed for June and July for hens that are confined?

Professor Lewis. When we cannot get anything on the surrounding land to feed to them we practice double yardage; we have a yard, say, the size of this room, divided into two parts, and grow peas and oats on the first yard while the birds are feeding on wheat planted the fall before in the second yard. As soon as the oats get up 4 or 5 inches we turn the birds over into that yard and seed this other yard to buckwheat, and as soon as the buckwheat gets 4 or 5 inches tall we turn them over on to that and grow soy beans on the other yard. That gives us an admirable amount of green feed. When the soy beans get up 5 or 6 inches we turn the birds back into that yard and grow wheat. We practice in this way a crop rotation, and it does not take very long. We simply go in there with a fine-tooth cultivator, and all except the first seeding we plant broadcast, and as soon as it is high enough we put the birds in. It takes a very short time to do this, and it supplies those birds with green feed just as though they were on free range, and, what is even better, it maintains in those yards absolutely sanitary conditions. It turns under the droppings and uses their fertility to grow the crops with, and has maintained cleanly conditions, whereas otherwise those yards would have been absolutely bare and an undesirable feeding ground.

Question. About how much yard room have you for 100 hens?

Professor LEWIS. We have there from virtually nothing up to free range. If I were putting up this house such as I described, I should want a yard for 100 hens at least 100 feet wide and 20 feet long, and practice double yarding as I have mentioned. Of course, I can grow other crops, like rape, which makes a very luxuriant growth. We grow a lot of rape for summer feeding to birds entirely confined. We have two flocks of 100 birds each which have never been out of the house for three years, and have made on an average $2.22 per bird. I am not recommending that, but am giving you an instance of the work we have been doing.

QUESTION. Is there any danger of the rape making the eggs taste?

Professor LEWIS. I have never had it do it, fed in moderate amounts, and we have fed birds right on it. I have heard of instances, however, where people claimed it had.

Mr. PARSONS. Do I understand that you have tried keeping hens confined for three years as against free range?

Professor LEWIS. Yes. The result of the free-range birds at the present time is about $1.98 in profit per year. The mortality has been nearly the same. The hatchability of the eggs of the confined birds has been very much below that of the eggs of the birds in the free range. Personally, my own opinion is this: birds which I was feeding for egg production I would keep more or less confined, except possibly during the summer when they were molting. My breeders I would let run as much as they wanted to and not force them for egg production, just previous to eggs for hatching. We have studied six or seven hundred eggs this last winter, with reference to their hatchability. We found that the dense albumen was apparent in all those cases where the eggs hatched, and there was 10 per cent less water than in the albumen of the eggs that did not hatch. We believe that a lot of poor hatching is due not to faulty incubation or faulty mating methods, but to the innate tendency of the bird to produce a watery albumen. There is not nutriment enough in that albumen to nourish the chick through twenty-one days and get it out of the shell. We are conducting some experiments on this line now, and expect to continue them during the coming year.

QUESTION. Would you condemn introducing an English white Wyandotte cockerel for reproduction?

Professor LEWIS. I hardly know what to say in answer to that. I would condemn it for this reason: the English white Wyandottes are not, in any sense of the word, white Wyandottes as I see them, — I want to be careful what I am saying, — and you are going to introduce into your strain of Wyandottes something entirely foreign to your particular breed, and I am afraid that the sum total of your results will be a good deal worse than if you let it alone. There are white Wyandottes bred according to the American standard which will lay just as many eggs as the English Wyandottes, and I believe you will get along better by finding in your own flock birds which are good producers and breeding from those. There is a possibility of doing a lot of harm by introducing these foreign types about which you know little, and furthermore, it is perfectly possible that you have in your own flock birds that are as good or better producers than the birds you are buying. I am convinced more and more of it, the more we get our poultrymen to use trap-nests. One of our big poultrymen, Charles Warner, has trap-nested 200 pullets, and he found birds that are absolute drones and birds that are laying over 200 eggs a year. All of you have got good hens, just as good as any hen, possibly, that ever made a record, and the thing is to find them, and after you find them, to use them intelligently, — get cockerels from them and use them in your breeding work. Every one of you here have got birds that are a great deal better than you think; find them, utilize them; that is the way Tom Barron got his birds, — finding out what were the good ones.

QUESTION. Would you use the second crop of hay for feeding?

Professor LEWIS. Yes, especially if it has clover or alfalfa in it. We go out into the haymow, sweep up the leaves and steam them for the poultry mash next winter, and if you have a lot of them it is a good practice to steam them and put them in troughs. A lot of those things you can use and find them of material advantage.

Mrs. GOODNOUGH. When you have a pen of good Rhode

Island Reds, and have cockerels in that same hatch, would it be detrimental to inbreed for one year?

Professor LEWIS. No; if they were extra good birds I certainly should not object to inbreeding for one year. Inbreeding does this, — it intensifies any characteristic the birds possess by eliminating any foreign characteristic that any other strain of birds might possess. If those birds are good birds and have a good color pattern, good body shape and good egg production, and are free from serious defects, — crooked breasts or legs or undesirable features, — it is certainly desirable to breed them together; but if they are low in vitality, if they have knock-knees and things of that kind and you inbreed them, you are going to intensify the bad characteristics. Inbreeding intensifies good as well as bad characteristics, and we can inbreed for a number of years provided we use, in our inbreeding, only selected birds which measure up to a certain standard. We practiced a lot of inbreeding at the New Jersey station and got very desirable birds from it.

QUESTION. Is not early fall laying a sign of a good layer?

Professor LEWIS. Within certain limits, yes. I would not want a bird that came to maturity so early that it was dwarfed. When a bird comes to maturity — I mean by that, when it starts laying — it stops growing, and if it comes to maturity too early, it will always lay small eggs and will be more or less of a bantam style; but I would say that with Leghorns, five months, and with Rocks, six and a half months, is about the right time. It is true that birds that start laying in from five to six months are better than birds that don't start laying till they are eight or nine or ten months; it is an indication of continued high production for a bird to start laying about the time it should. April-hatched birds ought to be well along in production before cold weather commences in the fall.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

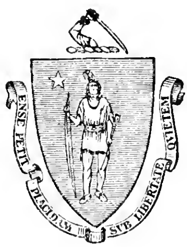
CIRCULAR No. 54.

February, 1916.

STANDARDIZATION OF FARM PRODUCTS.

CHARLES McCARTHY.

FROM THE SIXTY-THIRD ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.



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STANDARDIZATION OF FARM PRODUCTS.

CHARLES MCCARTHY, CHIEF OF LEGISLATIVE REFERENCE BUREAU, MADISON, WISCONSIN.

The appalling waste in our agricultural production has at last opened the eyes of our agricultural teachers in this country. The American passion for efficiency in business has at last made its way into the business of agriculture. We have at last brought ourselves to take notice of abandoned farms, the growth of tenantry and the high cost of living. We have wondered why farmers near Boston or New York with the finest markets are not able to sell their goods. We are now seeking a solution of that question. The solution we will find eventually is the solution we have already found in all other industries, — better business. We have got to do what Henry Ford did with the automobile business. We have got to Henry Fordize agriculture, that's all there is to it. If our minds have long been running in other channels, we will have to change, that is all. And we have got to Henry Fordize agriculture in the whole sense. We have got to have thorough organization; produce thoroughly good and guaranteed goods at the lowest cost; get higher pay for the producer; and get more and more profit-sharing both for the producer and the consumer as time goes on.

When you talk about not being able to compete with dairy products from Canada, New York or the west, what other solution is there but to organize, standardize, get at the cost of production, and then devise ways and means of reducing every little cost?

And you have got to advertise too. If you have good sanitary goods and it costs you to get them, make up your mind you are not going to sell them at what they are worth unless you constantly tell men over and over again how it pays them to get clean and wholesome products, or sound fruit or superior articles.

Now, all of this is not new, — it is not difficult even. It has been worked out time and time again. In one issue of the "Saturday Evening Post" there was an advertisement costing $21,000 from organizations of farmers raising citrous fruit, raisins and walnuts, who have Henry Fordized their products.

The Danes have beaten Henry Ford, for they have not only standardized their product, their processes and their animals, but they have gone further and organized on a purely co-operative basis, thus insuring the profit-sharing and the distribution of wealth to all, so essential to any rural efficiency.

I have read the Boston Chamber of Commerce milk report, and I know well that there are institutions which will not divide up and do not believe in profit-sharing. There is not safety in individual efficiency such as the Ford plan when applied to a rural situation. We want the Ford efficiency, but we cannot depend upon individual generosity. We must have the Danish democratic organization to insure the success of thorough organization.

You will not succeed if you merely Fordize. You must have democracy — the one man, one vote, basis — to go with it.

Massachusetts is not at all unlike Denmark or Holland or Belgium, and the lessons of those countries can well be applied here.

A movement has well begun to fix legislative standards, but those standards to be effective must be followed by the organization of milk dealers or fruit dealers and others to carry out those standards. State inspectors will help somewhat, but it is far better to have your own inspectors and then guarantee the product to the State. This does away with a thing which may become hateful in time, — the multiplicity of inspectors and the element of bureaucracy involved.

The milk dealers of Massachusetts should be organized under the co-operative law for the purpose of maintaining standards, working out the cost of production, advertising, making collective contracts with the big milk handlers, or actually putting up money and buying or building plants.

In this way every grading law or standardization law will bring profit into your pockets, and will not merely feed into the pockets of those who possess a monopoly of the means of transportation and selling. You will have your own brands and carefully uphold them, and uphold every effort by the State if you realize profit from them.

Farming is business, and every business method must be used to make it successful. No big business can exist to-day without a brand, advertising and standards of production, and without having a steady market. The telegraph and the telephone are necessary, and some central intelligence. Overhead costs must be estimated. Standardization is the basis for all this. By standardization the products can be brought to the market in sufficient quantities, at the time they are wanted, and to the place where they are wanted. By standardization the small farmer or the man on the moderately sized farm, — who, after all, is to be the man in America, or, for that matter, in any other country, upon whom the future of all agricultural industry must depend, — acquires the strength of the large farmer. If we have large farms then we are going to go into extensive cultivation, and, at the failure of that, into tenantry, with all its evils. The only way to maintain the small farmer is by standardization of his produce. He has got to produce material like his neighbor, and he has got to work with his neighbor in buying and selling. He has got to organize so that the business end of it is concentrated and the bookkeeping end of it is concentrated. I shall not go into an analysis of the standardization laws, but this I may say, that there is a tremendous chaos coming at the present time. It is proposed to fix standards by the national government. We have already the Sulzer apple standard. Then different States are getting up standards. Many of these standards go into detail, as your law in Massachusetts does, as to size of apples, etc. A good deal of this is dangerous and unreliable. Some of it is necessary in legislation, but what is necessary and what is unreliable will have to be worked out. Some essentials can be laid down in the law. The rest can be given to a board of agriculture to work out, as administrative rules to be carried out through organizations. But in all cases there should be committees composed of men who would use their actual knowledge of business in determining these rules, so that the rules will not be made theoretical; also, they should be changed from year to year as the conditions change. Their main enforcement should be through organizations. If different States have such arrangements as this, it will not be difficult for the marketing departments or the boards of agriculture of the different States to meet with the national agricultural department and make uniform rules or national standards. That, however, is a far distant day, it seems to me.

I served on a commission on uniform legislation for many years, as a member from my State. I know that uniformity looks good in theory, but in practice there is a vast difference between the products of Oregon, those of Massachusetts and those of Florida. Nevertheless, uniformity over districts through regulations laid down by boards meeting together is a possible thing and something which can be worked out.

The different Massachusetts laws now for grading of produce or standardization should have an added phrase to the effect that the standards laid down in the law may be changed by the State Board of Health, if an advisory committee is called in from the agricultural interests of the State. Whatever method is used it is certain that standardization laws are but a step. They must be accompanied by every other means which business industry in general has found efficient, — by brands, advertisement, central office, cost accounting, transportation departments, the telephone and the telegraph, etc., — in short, by the organization of business on an efficient basis.

None of this, however, will avail us if, in the end, the whole organization is not upon a co-operative basis instead of a corporation basis. Sir Horace Plunkett has well shown the difference when he says that "If one man has fifty shares of stock and one cow, and another man has fifty cows and one share of stock, the man who owns the stock will milk the man who milks the cow." If such organization is not on the right basis we will have little trusts bleeding the farmers, leading, perhaps, into big trusts, rather than that prosperity of the farmer which should be the result of efficiency. Some of the worst little trusts that exist in this country — trusts making unheard-of profits — are so-called co-operative organizations or farmers' organizations organized upon the joint-stock basis. The nonstockholder is fooled. He cannot remove his land or his goods, and must contribute to the 20, 30 or 40 per cent made by some of these so-called co-operative organizations.

Some one has said that the American farmer will organize when he has to do so. I am asking you, then, who have struggled with agriculture in New England, whether you have not very good evidence of the fact that you have got to do it. Every report that I have ever seen from New England convinces me that New England is a portion of the country in which a farmer will not be able to live and enjoy a fairly decent degree of prosperity unless the farmers get together pretty soon and organize and carry out a program similar to that carried out in Holland, Denmark and Germany. That this can be done is evidenced by the wonderful progress in what was one time the most economically disorderly country in the world, — Ireland. A remarkable change has come over the people since Sir Horace Plunkett began his great work there. That it can be done is evidenced in every State in the country now, for a recent bulletin issued by the Department of Agriculture at Washington estimated that at least $1,000,000,000 worth of produce had been sold by organizations of this kind within the last year.

The CHAIRMAN (Mr. WILFRID WHEELER). The meeting is now open for discussion, and I hope there will be some questions that Mr. McCarthy can answer on this question of grades and standards. Our department is already prepared to build this year along some of the lines Mr. McCarthy has mentioned, by having a department of the Board of Agriculture which will have the power to fix grades and standards of agricultural crops here in the State, so that we will be able to co-operate with the United States government and other States in this very thing. As he says, the fact that a grade or standard is established by law may be a mistake; it may be a hard thing to fix by law, and we are working on that very line, and I hope that a law will be passed this year to give the Bureau of Markets or the State Board of Agriculture the power to regulate this question of grades and standards so that it will be in conformity with the other States or with the United States government. If there are any questions, or if there is any discussion you would like to bring out, I am sure Mr. McCarthy would be glad to answer.

QUESTION. Wouldn't it help things to have everybody put their names on their packages of products?

Mr. McCARTHY. That would have to be done for the thing to be of any value; that is essential to this whole plan. In the Danish egg, for instance, there is a brand put upon the egg, so you can trace the product back to the organization. So, in all the butter standards that I have seen, there is a sign of some kind, a letter or something, which will show exactly the man or the organization that had that product, so that you can trace the thing back as you would in bookkeeping. That is essential. Then you can put the responsibility upon the man who got up the product. I think that it is absolutely essential that you should do that, but of course you know there is going to be very great opposition to it. The great middlemen who buy this produce want to put their own names and labels on it, and they will cut off your label or will refuse to buy your material if it is labeled. There ought to be, in my opinion, national legislation to protect the man who wants to put a label upon his produce. Some of our material in Wisconsin is labeled, goes down to the Chicago market, and the buyers or packers down there take the label off and then you cannot tell whose material it is. You should be able to trace it right back to where it comes from; that is essential. The Dutch brands look like dollar bills. There is a number up in the corner, and on the butter keg there is a label. You buy these labels from the government; the government then has your record, who you are and who bought them, and can trace every piece of material you buy.

Mr. W. H. ATKINS. This year is a good beet year. I understand in New Jersey and elsewhere large quantities went to waste. It seems a pity that large crops should go to waste, and your talk along the line of contributing knowledge as to where the buying centers might be is of interest. I know that Holyoke could have used several carloads more of peaches, provided they could have been brought in there and placed before the public at a reasonable price so they could get hold of them, while I understand there were people in New Jersey who could not sell them. I understand there was a man who offered carloads of them at 15 cents a basket after he got them and could not find a market. Could the government do anything to open up a market? If those cars could have been sent to Holyoke and the consumers could have got them at 50 cents a basket they would have been sold.

Mr. McCarthy. There isn't a doubt that a great deal of the peach crop this year could have been taken care of in the smaller places if there was a wholesaler in that region who knew how to take that stuff and deal in it, or if there was some open market place. Just see how that open market place would act. If you had the open market place you could bill the town. In many of these cities the country papers or little city papers will not take an advertisement of produce that is in the market place, because the advertisers, who are the retailers around there, will not stand for it; but you can always bill the town and say there are so many barrels of apples or peaches in the market, and you can make up your mind that the women are coming there and going to get them at prices worth while to the shipper. I think there probably was an overproduction of peaches this year, considering the means of transportation in this country and the unorganized state of the market, but that overproduction could be easily taken care of if we had some machinery for distributing it through the smaller places. I know that the Sun-kist orange people at the present time have been eliminating the wholesaler in a great many places, and they are getting down to the retailer. If you will notice in many of the cities this year the Sun-kist orange people are advertising in the country papers. A city like Chicago will have a great lot of stuff dumped into it, and sometimes the machinery for distributing this produce into smaller places where there are no good wholesale houses or public markets is not sufficiently worked out. I know an express company man dealing with one of the big food divisions of the express company, who, as an experiment, began to advertise and put into a lot of country towns some of this peach product, and where they would say in one place, "Well, we could dispose of 10 bushels," he told me that he often put in 75 and 100 bushels. So you can see that our distribution of our produce is in a very crude condition; we haven't got it mapped. Why? Louis Brandeis of Boston said that the railroads of this country wasted $300,000,000 a year. I don't doubt but you could prove that they wasted a great deal more than that in another sense, for the railroads, with their agricultural experts, have been building up, down along their lines, farmers' districts for horticulture, for agriculture, and then allowed wasteful dumping into the big centers. All the traffic managers seemed to care about on some of these railroads was that they get the material on to the cars, get the stuff into the big centers and get the freight for it. The railroads in the end suffer for it, because the farmers are more or less discouraged in some portions of the country, and will not produce in the same way another year. Because of the fact that the railroads have not mapped the traffic of this country, or have not combined to take care of the markets in a scientific way, they have no doubt wasted millions and millions of dollars. I said to a railroad man the other day, "One of the best arguments for government ownership that could be made against you men would be the handling of the products of last year."

QUESTION. How would you standardize the milk for Boston?

MR. MCCARTHY. I am not going into that problem. New York gives you, in some ways, an example of what could be done, but your situation is a difficult and peculiar one. There is one sure thing I can say, that organization in this district would be a far better thing for you than to be in your present unorganized condition. Your only salvation in this district is to work for standardization and then work to reduce your cost of production by collective action. You can standardize almost any kind of produce. I have seen in Holland the standardization of almost every kind of vegetable possible. In nearly all Holland, now, the ordinary vegetables that come in are in some degree standardized. They are sold by lots at auction and the buyers must sit up in a big stand and look at the lot and then bid upon the lot, and the sample must correspond to the entire lot. You would be surprised to see how well you can standardize all sorts of difficult things. There is hardly anything that you can't work out with some kind of standard.

Mr. A. H. Wheat. You spoke of goods being sold in Holland at auction; what class of people buy them at auction?

Mr. McCarthy. The wholesalers generally buy the material to be sent out of the country, — to England or some place like that; or the co-operative societies buy it. I saw an agent for a big co-operative society buying a lot of goods in one of these auctions in Holland; but generally it is the wholesaler. The process there is very interesting. As I say, there will be a grand stand, and all these buyers who come there have to sit up on the grand stand; they cannot go around to you and bargain with you individually; they must sit up on the grand stand and pay for it. They have a little button in front of them which is connected with a great big dial, and they press the button when the price at which they want to buy shows up on the dial; they take the lot before them on that. They are up there to make a collective bargain with the collective farmer. I have seen that all over Holland. I have seen it in one place where there was a stream of water, — Holland being nearly all water, — and a boat was drawn down the stream of water and had on it the different little lots of potatoes and vegetables and all kinds of produce, and they bid upon these lots as the boat went by in front of them. All they did was to look at the stuff, and any question in dispute was referred to a court of arbitration composed of one representative of the farmers, one of the buyers, and a third man appointed by the municipality. The farmers, of course, had to bring their stuff in according to the sample. It was the wholesalers or big buyers in nearly every instance who bought it in that way from the farmers.

Mr. Wheat. Those are the buyers that sold to the retailers after that, are they?

Mr. McCarthy. Yes, you know over there in those countries a co-operative organization is a wholesale organization, after all; that is, if you were in Denmark you would see the office of the English Co-operative Wholesale Society, which does a business, I think, of $700,000,000 a year, and they buy for all the different little member organizations in a wholesale way.

Mr. Wheat. Does that auction come any nearer to the consumer than our commission or fruit auction does here?

Mr. McCarthy. Well, I could not say, because I am not familiar with the system here, but I imagine that when you take the Co-operative Wholesale Society of England, buying that way in a large lot for, we will say, a thousand grocery stores, it comes very much nearer than anything we would have here.

Mr. Wheat. That is, the co-operative association is similar to the Liverpool market, isn't it? If we want onions there we buy them in Liverpool.

Mr. McCarthy. In the manufacturing districts over there the people unite and have their own grocery stores and trading stores of all kinds, and these little units are united in a great big wholesale co-operative society. They own the stores themselves so there is no profit in that except the salaries of the officials that the people themselves hire; there is no money that can come out of it in any other sense.

Mr. Wheat. They are strictly co-operative?

Mr. McCarthy. Strictly co-operative, on a one man, one vote, basis. They own their own vessels, have their tea plantations in Ceylon, have organizations in Canada for buying cheese and apples for them, and I think they have some agency in this country. It is a great big organization that the people themselves own, and it has existed sixty years or more and does a business of between $700,000,000 and $800,000,000. Of course when they buy that way the process is very much cheapened. Professor Mezes, of the City College of New York, reckons that the Danes, by selling that way, reduce the cost of selling from 35 to 2½ cents on the dollar.

Mr. Wheat. They sell in large quantities?

Mr. McCarthy. Yes, sell in large quantities and do away with jobbers and middlemen. I met a man in Wisconsin who sold produce, and he told me that he knocked out two middlemen between Wisconsin and New York by coming to New York and guaranteeing the standard of a million pounds of butter. He said he did not go to Chicago at all, but sent the article on to New York and knocked out two or three of these men.

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CANNING IN GLASS IN THE HOME.

Sarah Elizabeth Belt.

From the Sixty-third Annual Report of the Massachusetts State Board of Agriculture.

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CANNING IN GLASS IN THE HOME.

(FRUITS, VEGETABLES AND MEATS.)

MRS. SARAH ELIZABETH BELT, MELROSE, MASSACHUSETTS.

This is a subject that interests almost every housewife, especially when the prices of food are so high. Did it ever occur to the housewife that the unnecessary waste of fruits, vegetables and meats on the farm and in our gardens could be saved, and be available for use in the middle of winter, if she would take a little more time when the fruits and vegetables are in season and can them? The great objection in previous years has been that the open kettle method of canning was tedious and took up considerable time, but by using the cold pack method of to-day canning has become a pleasure instead of work. By using this method it will be possible to have all kinds of fruits and vegetables, as if right from the garden, in the dead of winter. The housewife will also be able to keep her table supplied with all the delicacies out of season at a very small cost. Arrangements can be made so that while fruit and vegetables are sterilizing other work may be attended to. In this way the plan of work for the day is not upset.

Bacteria, Yeasts and Molds.

Every piece of fruit, vegetable or meat, no matter how fresh, is filled with tiny invisible spores or parasites which cause it to spoil. The air, no matter how clear it may look, is filled with these tiny organisms. These organisms are divided into three classes, — yeast spores, which attack fruit; bacteria, which attack vegetables and meats; molds, which attack jellies and jams. Yeast spores are killed by a lower degree of temperature than bacteria, therefore a short sterilizing is sufficient for killing the yeast in fruit.

Bacteria, however, resist destruction by heat for a long time. Two and even more hours at boiling point (212° F.) is required to render all vegetables and meats proof against spoiling. Molds are generally killed at the temperature of boiling water.

Bacteria are so small that they can only be seen with a microscope, and they reproduce themselves with amazing rapidity.

One bacterium under favorable conditions will reproduce itself about 20,000,000 times in the course of twenty-four hours. Accordingly, certain vegetables spoil more rapidly because they furnish a better medium for bacterial growth.

The reproduction of bacteria is brought about by one of two processes, — the germ either divides itself into two parts, making two bacteria where one existed before, or else reproduces itself by means of spores. These spores are compared to the seeds of an ordinary plant, and they present the chief difficulty in canning vegetables, meats and fish. While the parent bacteria are readily killed at the temperature of boiling water these spores retain their vitality for a long time even at that temperature, and in cooling will germinate, and the newly formed bacteria will begin their destructive work. Therefore it is necessary, in order to completely sterilize a vegetable, meat or fish, to heat it to the boiling point of water and keep it at that temperature for two or more hours.

This boiling of foods and dishes to free them from all germ life is called sterilization. Unless fruits, meats and vegetables are boiled long enough to destroy this germ life they are not sterile and will surely spoil. Once sterilized the food and the inside of the jar must be protected from the air, which as I said before is filled with these tiny microbes. Unless it is absolutely and permanently protected it will surely be attacked by these germs and it will spoil.

Jars.

It is not necessary to protect all sterilized foods from the light, but in order to keep them sterile they must be encased in an air-tight jar. This jar must not only be air-tight at the time of canning, but must remain so until opened. The first requisite for successful canning is a good jar. There are many kinds of glass jars, — the old and the new improved Mason jar with a screw top, and the jar with a rubber ring and glass top, of which there are several varieties. These tops are held in place by a simple wire spring. Fruits, vegetables and meats often spoil by the use of defective rings. It is poor economy to buy cheap rubbers or to use them a second time. Let me say right here that it is a good plan to test your rubbers before using them, by pulling the rubber out and letting it spring back into shape. If it does not respond readily you will know it is not good.

Another type of jar in common use is the one with the self-sealing metal top lacquered on both sides. These jars require no rubber rings, as the groove in the top contains a composition of the consistency of rubber, which is melted during canning by the heat of the jar. This band takes the place of a rubber ring.

If the jar and the food are not absolutely sterilized this jar warns you of the fact by loosening its cap and unsealing itself. This is due to the fact that the germs cause a gas to form which loosens the cap.

This type of jar seals itself by air pressure. When the food in the jar is hot it is very much expanded, but in cooling it shrinks and causes a vacuum. In shrinking it draws the cap down tight, and by atmospheric pressure (15 pounds to the square inch) holds it tighter and tighter, until when cold it is impossible to pull it off.

Sterilizers.

There are two principal types of sterilizers, — the first is the hot water bath outfit, which consists of an ordinary wash boiler with a rack that sets on the bottom to set your jars on so as to avoid breakage; the other method is the steam pressure canner.

By using the latter sterilizer or canner your fruits are canned by steam pressure instead of hot water. The food is cooked in receptacles placed over water which is heated to a temperature sufficient to make steam, and held there at that temperature the required time. On the cover of the steam canner there is a steam gauge, a safety valve and an exhaust cock.

The steam gauge registers the number of pounds' pressure, also the degrees of temperature.

The safety valve exhausts the excess steam, thereby keeping the required number of pounds' pressure.

The exhaust cock is to release all the pressure from the canner. This last device is absolutely necessary. Great care must be taken in releasing this pressure slowly, as a sudden release has a tendency to draw the water out of the jar and lift the cap.

In taking the jars out, when the sterilization is completed, it is important, in order to avoid breakage, to see that the hot jars do not come in contact with a cool draft of air. Any one that has ever done any canning will know that a sudden change of temperature will break hot glass. Therefore you must have your doors and windows closed while you are taking the jars out of the sterilizer. Be careful and do not set them on the table in the kitchen or shelf in the pantry in a draft, but place them on a towel or a thick pad.

Methods of Packing.

Two methods are used in canning, the open kettle method and the cold pack method. The first method consists of boiling in the open kettle, and then pouring into your jars while hot and then sealing. The second method is that of sterilizing or boiling your fruits, vegetables or meats either whole or sliced in the jar. In using the first method you have to stand over the hot stove and get overheated, while in the second method you use everything practically cold.

Pears.

For pears make the sirup first, so that you can set it aside to cool while you are preparing the fruit for the jars. Now in regard to the proportions of sugar and water for the sirup, some prefer a thick sirup, some a medium and some a thin sirup. For a thick sirup, use 1½ pints of sugar to 1 pint of water; for a medium sirup, equal proportions, 1 pint of sugar to 1 pint of water; and for a thin sirup, 1 pint of sugar to 1½ pints of water. Place your sugar and water in a saucepan upon the stove, bring it to a boil and let it boil slowly for five minutes, taking off the scum which rises to the top before it boils. While this is cooling select firm and perfect fruit, wash and pour boiling water over it, and let stand for about two minutes; then plunge into cold water and remove skins. Halve or quarter, as you prefer, and pack into the jars (which have been thoroughly cleansed in cold or lukewarm water). Fill to the brim with the cool sirup, place on your rubbers and glass tops, and clamp but do not tighten. If using the jar with the metal cap, first dip the cap in cold water, then place it on the jar, and clamp. If using the hot water bath outfit place the jars on the rack in the boiler and fill to the neck of the jars with cold water. Place on the cover and count your time of sterilizing from the time the water in the boiler begins to boil, keeping it at boiling point for twenty minutes to one-half an hour, according to the ripeness of the fruit. If you are using the steam pressure canner do exactly the same way, and when the jars are ready for the canner lower the crate into the retort after placing the jars in the crate. There should be 2 inches of water in the retort. Place on the cover of the canner and tighten the clamps so there will be absolutely no leakage, and bring the steam up to 5 pounds' pressure, keeping it at that pressure eight to ten minutes, according to the ripeness of the fruit. Right here let me give the reasons for scalding: first, to remove the skins without loss of pulp; second, to eliminate all objectionable acids; third, to start the flow of coloring matter. The reasons for the cold dip are, first, to separate the skins and harden the pulp; second, to stop the flow of coloring matter; and third, to render packing easier.

Apples.

In regard to the canning of apples, I might say there are more apples wasted than any other fruit in the United States. You will probably say to yourselves, or to each other, what is the use of canning apples when you can put them away in cold storage and keep them indefinitely. That is all very well, but the apples that you put away in cold storage are not the apples that are allowed to lie on the ground and go to waste, — they are not the windfall apples. When I say windfall apples I do not mean the apples that are allowed to lie on the ground for two or three days or more. I mean the apples that have fallen off in the course of twenty-four hours and have not been allowed to lie on the ground, and decompose where they have been bruised by falling. Apples have no equal as an all-around fruit. The best apple for canning is the late fall or the early winter variety. Summer apples are not good for canning purposes, as they almost always turn soft when cooked.

To can apples whole, wash, core and peel, cut out all the decayed spots to keep the apples from discoloring, drop them immediately in a light brine (1 teaspoonful of salt to 1 quart of water), let stand for four or five minutes, and then rinse them off in cold water and pack in jars. Fill to the brim with cold water or sirup. Cap and clamp and sterilize for twenty minutes in the hot water bath outfit, or six minutes in the steam canner under 5 pounds' pressure. These are very nice for apple dumplings. Do exactly the same way for sliced apples, slicing the apples and then packing them in the jars and sterilizing fifteen minutes in the hot water bath outfit and four minutes in the steam canner under 5 pounds' pressure.

Vegetables.

The first step in successful canning of vegetables is the selection and the preparation. Have your vegetables as fresh as possible. They are best gathered in the early morning, and if not convenient to can them immediately do not allow them to wither, but set them aside in a cool, damp place or in a pan of cold water, and keep them crisp until you are ready to use them.

Corn.

Most people think it is one of the hardest vegetables to can, but I find it one of the easiest to do and keep. The Department of Agriculture at Washington has shown us that the amount of sugar in the sweet varieties diminishes very rapidly after it is pulled from the stalk. The ear loses 50 per cent. of its sweetness overnight; therefore to obtain its original flavor it is necessary to can it very soon after it is gathered. Select ears with full grains, husk them, brush off the silk with a stiff brush kept for that purpose, and blanch in boiling water ten to fifteen minutes. This is done to eliminate all objectionable acids and to start the flow of coloring matter. Plunge into cold water to set the color bodies and render packing easier, and pack in jars alternately, butts and tips. Add 1 teaspoonful of salt to each quart jar, fill to the brim with cold water, place on your rubber rings and your tops, and sterilize for four hours in the hot water bath outfit. If using the steam pressure canner place your jars in the crate, lower them into the retort, which should have 2 inches of water in it, put on the cover and clamp, being sure there is absolutely no leakage, bring the steam up to 15 pounds' pressure and keep it there for sixty minutes.

For corn off the cob cut the corn off after the cold plunge, pack in the jars and proceed the same as with corn on the cob.

String Beans.

Have your beans as fresh from the vines as possible, and be sure all pods are tender. Wash, break in convenient lengths, or leave them whole, as you prefer, blanch in boiling water from three to five minutes, plunge into cold water, pack in jars, fill to the brim with cold water, place on rubbers and caps, and clamp. Sterilize in the hot water bath outfit for three hours, or in the canner fifty minutes at 8 pounds' pressure.

Greens: Spinach Swiss Chard, Dandelions and Beet Tops.

Wash, blanch in boiling water for five minutes, plunge into cold water, pack into jars solid, fill to the brim with cold water, place on rubbers and tops, clamp, and sterilize in the hot water bath outfit one hour or thirty minutes under 5 pounds' pressure in the canner.

The reason for the shorter sterilization for greens than for beans or corn is that they do not furnish as good a medium for the bacterial growth. Bacteria do not thrive in vegetables containing a large amount of acids, which is why rhubarb will keep without being sterilized. The tomato does not contain so much acid as rhubarb, yet it has sufficient acid to prevent the growth of more troublesome forms of bacteria.

Tomatoes.

To can tomatoes whole, grade for ripeness, size and quality. Scald to loosen the skin, plunge into cold water, remove skins, pack whole. Fill the jars with tomatoes only and add 1 level teaspoonful of salt to each quart. Place on your rubbers and tops and sterilize twenty-two minutes in the hot water bath outfit and ten minutes under 5 pounds' pressure in the steam canner.

To can sliced tomatoes, scald, plunge into cold water, remove the skins and cut up a few tomatoes. Put in a preserving kettle and boil twenty minutes. Remove from the fire and strain. Set this aside to cool, and while cooling select ripe tomatoes. Scald to loosen the skin, plunge into cold water, remove the skins and slice. Pack neatly in the jar and add 1 level teaspoonful of salt to each quart, and then pour in the strained liquid, filling the jar to the brim. Place on rubbers and caps and proceed the same as for whole tomatoes.

Carrots and Beets.

Blanch in boiling water, plunge into cold water, remove skins and pack whole or sliced, just as you prefer. Fill jars to the brim with cold water. Place on your rubbers and caps and sterilize in the hot water bath outfit for one hour and a half, or forty-five minutes under 5 pounds' steam pressure.

Meats.

Judging from past experiences I find that few women are in the habit of canning meats, thinking it too difficult. Personally, I do not find it difficult if the cold pack method is used. We all know it is very convenient to have canned chicken, canned cornbeef, roast beef, roast lamb and veal or, in fact, any kind of meat on hand, especially in the summer time for use at camps or picnics. We find that meats as well as some vegetables furnish a better medium for bacterial growth; therefore you must give them a thorough sterilization. Meats should be cooked right in the jar, and not exposed to the air after boiling. If they are cooked in the open kettle and poured into the jar it gives the bacteria a chance to get on the food, and there is danger of spoiling.

To can chicken, cut up as for an ordinary stew or fricassee, leaving in some of the bones. Pack in jars. Add pepper and salt to taste, and fill jars to the brim with cold water. Put on the rubbers and tops, and clamp. Sterilize for three hours in the hot water bath outfit, or sixty minutes under 15 pounds' pressure.

To can fresh beef, wash and cut in cubes. Pack in jars (after they have been wiped with a sterilized cloth kept for that purpose). Add a little fat and a teaspoonful of salt to each pint of meat. Place on rubbers and tops and sterilize in the hot water bath outfit three hours, or sixty minutes under 15 pounds' pressure.

To can all kinds of roast meats, roast the meats in the usual way, and when cold slice and pack in the jars solid. Fill to the brim with the juices or gravies. Place on the rubbers and tops and sterilize in the hot water bath outfit three hours, or sixty minutes under 15 pounds' pressure.

To can roast or fried chicken, turkey, duck or any game, dress and roast thirty minutes in a hot oven. When cool, cut up and pack in jars and fill jars with gravy. Place on the rubbers and tops and sterilize in the hot water bath outfit for three hours, or sixty minutes under 15 pounds' pressure.

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FARM MANAGEMENT:

Its Application to Southern New England Conditions.

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FARM MANAGEMENT: ITS APPLICATION TO SOUTHERN NEW ENGLAND CONDITIONS.

J. S. CATES, AGRICULTURIST IN CHARGE OF NORTHEASTERN STATES, BUREAU OF FARM MANAGEMENT, UNITED STATES DEPARTMENT OF AGRICULTURE.

Farm management considers farming as a business, and attempts to analyze the various factors having to do with the success or failure of that business as it is found conducted on the individual farm, and in so far as possible to determine the broad outstanding factors for efficiency which admit of general application to the region.

The solution of many of the practical problems of agriculture which have been worked out by various scientific experimenters are found to have already been solved generations previous by large groups of farmers. Particularly is this true of farm organization and management. Every farmer is of necessity more or less of an experimenter. The results of thousands of such experimenters gathered by the investigator, classified and interpreted in their bearing on the community's problems, and on the individual farm's problems, yield not only many fundamental broadly applicable principles of good farm organization, but also show in more or less detail just in what respect a successfully operated farm differs from one which is a failure or only moderately successful.

In previous decades the agricultural investigator largely concerned himself with the study of how to accomplish certain ends; for example, how best to feed a pig or a cow, how best to raise potatoes or fruit. The farm management investigator is concerned with the study of whether to feed a cow or a pig, whether to raise fruit or potatoes; and if an industry be found to be desirable, to what extent it should enter into the farm organization, and with what intensity it should be pursued. All of these problems have in the aggregate been solved by the farmers. Farm management is merely a scientific method of classifying and interpreting the collective experience of the farming people as to what constitutes efficiency in farming.

Farm management deals with the principles which underlie profitable farming. These principles are not unlike those which underlie the profitable conduct of any business. The difference is merely in the application. The one fundamental principle underlying all successful business undertaking is that the cost must be less than the selling price. In the operation of this principle, agriculture is no exception. Farming, however, is such a complex business, and the different enterprises making up the farm unit are so intricately related, that it is often well-nigh impossible to determine the true cost or the true selling price of a farm product. However, the relation of any factor in farming to the profit of the farm as a whole, by the study of a large group of farms, can be fairly accurately determined. This relation of the individual enterprise to the profits of the whole is perhaps the best guide to successful farming and to an understanding of the principles upon which good farm organization is based.

One of the first and most important factors having to do with profitable farming, as in all other lines of business, is the size of the enterprise. There are several measures of size of a farming enterprise. Perhaps in general farming of the same type the area of the farm furnishes the most significant measure of size. Of course, size in acres cannot be used in comparing a truck farm or a farm of any intensive type with a general farm. Despite the much talked of idea of "a little farm well tilled," actual records from thousands of farms covering pretty well the whole United States go to show that little farms do not often make big profits, and that as a rule the profits from farming vary directly with the size of the business. It might, however, be pointed out in this connection that the opportunities for loss vary also in the same way.

In the study of the agriculture of Chester County, Pennsylvania, of 115 farms of the group of 60 acres and under, averaging 40 acres, only 8 per cent. made labor incomes of $1,000 or more, and the average for the group was $404. Of the group ranging in size from 161 to 393 acres, averaging 203 acres, 68 per cent. made $1,000 or more, the average for the whole group being $1,575.

In a similar study made in the extensive farm region of the upper Mississippi valley States, the 160-acre farm groups gave an income over five times that of the 40-acre group. Results closely paralleling these are secured wherever such studies are made of comparable types of farming. It is not surprising that this is true when we consider some of the handicaps under which the small farm is operated. For instance, in the group of large farms in the Chester County area the value of machinery equipment per acre of crops was only about one-half that of the small-farm group, and the crop acres per horse was nearly double, as was also the crop acres per man. Furthermore, a small farm is rarely ever adequately supplied with equipment.

A recent study of machinery equipment on over 1,100 farms in western New York State showed that when, for instance, a sulky plow was used to cover 15 acres annually, the cost per day of use for the machine alone was 83 cents. When this same plow was used to cover 55 acres annually the cost was reduced to 57 cents per day. A grain drill when used to cover 20 acres annually cost per day used, $2.97. When used to cover 117 acres annually the cost per day dropped to $1.04. A grain binder when used to cover 15 acres per year, cost per day used the surprising sum of $8.15. When used to cover 85 acres per year the cost per day used was $2.41.

Another striking disadvantage of a small farm is that the restricted acreage does not permit of a sufficient diversification in the farm enterprises to furnish a good, even, all the year round employment of labor. As a result, the labor employed by the year is often idle for long periods. Whether this labor be hired, or be the services of the farmer himself and his family, the results are all the same. Rather than be idle for a long period this labor might well be employed in some industry which yields even but slight profit. In the larger sized farms this factor can easily be provided for. The minimum size of a farm for efficiency should be such as will furnish opportunity for adequate employment for both labor, machinery equipment and work stock.

It is not always possible for a farmer to enlarge his business by investing more capital until it shall have reached the optimum size. He can, however, quite often rent additional land. In many parts of the United States the figure paid for land rental, either in cash or in part of the crops, amounts to considerably less than a normal interest charge. A study of three groups of tenant farms located in Indiana, Illinois and Iowa showed that the tenants paid on the average a rental equivalent to only 3.5 per cent of the value of the farm. A farmer with restricted means, therefore, under such circumstances need not worry about the inability to purchase when he can rent more cheaply than own.

The diversity of enterprises making up the farm unit shows an important relation to profit. The successful farm usually has from three to five important sources of income. There are some extraordinary circumstances under which a farmer may find it more profitable to raise only a single crop, and even to buy feed to supply his live stock, than to engage in diversified farming. These conditions are exceptional, however, and such a farm is always subject to disaster through the failing of that single crop, as well as through failure of market conditions. And, furthermore, no single cropping system offers the opportunity for continuous employment throughout the year, while with diversified agriculture the leaks caused by idle seasons can be largely overcome.

Live stock on a farm usually helps greatly in furnishing continuous employment. Live stock is primarily a method the farmer employs of marketing his produce, and the live-stock yield must be equivalent to the market price of the feed or a loss is occasioned; but if live stock yields even a small margin over current prices of feed, yet the labor employed in caring for the stock would be otherwise idle, then the industry becomes highly desirable and contributes to the profit of the farm.

The factor of profitable farming which has probably heretofore received more attention than any other has been what might be termed efficiency, that is, the yield of crops and production per animal. As a rule, crop yields for a community are considerably below what would be the most profitable, and production per animal is decidedly below what has been shown to be the most profitable. In case of crop yields, however, investigations have shown that the biggest yield is not, by any means, always the most profitable yields. As a rule, the most profitable yield of crops for the community ranges from 15 to 30 per cent above the average of the good farmers of that community. If the yield rises much above this figure the profits of the farmer's business are usually found to decrease. It is possible to suffer from too big crop yields. Quite a few American farmers have reached this point. The optimum yield for greatest profit, of course, varies widely with different soils and economic conditions.

Studies of one large group of Pennsylvania farms showed that when the yield of crops reached a point about 35 per cent above the average for the region there was a sharp decrease in profits. The price of products as related to the relative costs of yields of different magnitudes seems to be the governing factor in determining the most profitable yield. Survey studies indicate that very few farmers are producing as large crop yields as existing economic conditions warrant.

Farm practice, in the aggregate, always responds to changed prices of commodities, but this response by the individual farmer, in the majority of cases, is made far more slowly than the greatest profit would indicate.

To illustrate how the yield is determined by prevailing price of a product, the case of corn in North Carolina may be cited. In the decade previous to the last the average price per bushel of corn in that State was about 55 cents. The yield per acre was around 13 bushels. During the past decade the price has ranged around 85 cents a bushel, and the yield has increased to about 20 bushels per acre. The explanation of this probably lies in the fact that under the higher prevailing price it became profitable to use more fertilizer and legumes and give better tillage to the crop than under the low scale of prices. No doubt the average yield is yet far below what would be the most profitable under existing conditions.

Survey studies have never disclosed, however, a group of farms on which the yield per cow had reached a point above which profits decreased. There does seem to be a point in yield per cow above which increased yield is not accompanied by much further economy of feed. Recent studies of feed cost as related to milk yield, made on four farms located, respectively, in Michigan, Wisconsin, Pennsylvania and North Carolina, running for five years and involving careful, complete, yearly records of 443 cow years, indicate that this point is reached at a yield of between 6,000 and 7,000 pounds of milk.

The cost of feed per 100 pounds of milk decreases rapidly until about 6,000 pounds' yield, after which the decline in cost is very slight. The lesson from this study is that it is of much greater importance to increase the milk yield up to between 6,000 and 7,000 pounds than it is to attempt to get the yield above this figure, as far as the economy of the use of feed is concerned. It is easier to increase the quantity of milk when it is low than when it is high. It is also easier to increase low crop yields than it is to raise already high ones. Furthermore, in both cases increasing a low yield is the most profitable thing to do. In dairying, a high standard of production per cow is usually the keynote of success. According to the recent Pennsylvania study of 289 dairy farms, 48 of these farms showed a yield per cow of less than $50. The labor income of these farms was 45 per cent below the general average. Twenty-eight farmers of the group had incomes per cow of more than $120, and their labor income was 75 per cent above the average.

Perhaps the most conspicuous cause of success in farming is prompt and fitting change in type of farming in response to economic pressure, as indicated by the market price of products as related to cost. The American farmers who are most successful usually sense the operation of economic forces far ahead of their neighbors. A large number of farmers change an old established system only when forced by dire necessity. Not only is there the greatest opportunity to any individual farmer through quickly modifying his organization in response to changed markets, but such readjustment is of great value to the whole community, for such action in time becomes corrective of the changed condition from which it sprang. Let us assume, for instance, that there is a community engaged largely in live-stock production, and that through some cause feed prices advance to such a point that there is more money in selling the raw product than in feeding. Under such conditions a large number of far-seeing farmers will quickly curtail their live-stock industry and become sellers of raw products. This, in turn, has a tendency to reduce feed prices and to increase the price of live-stock products, thus bringing about the old balance.

The farming business which is of efficient size, and which is made up of diverse units, put together in such a way as to operate smoothly and well, with full employment of both labor and horse and machinery equipment, provided supervision is adequate and the enterprises making up the farm are selected wisely and are efficient, complies closely with the outstanding factors of profit.

In order properly to understand the application of the foregoing principles of farm management to the agriculture of southern New England, a brief review of the economic history of the agriculture of the region is in order.

New England agriculture was established at a time of hand work. The family farm necessarily had to be small, that is, within the limits of what they could do by hand. This was also before the days of big factories. There being no large cities there was very little market for farm products. The farmers therefore very naturally fell into the habit of utilizing the long winters in manufacturing small articles for home consumption and for sale. Under these conditions the New England farmer prospered. Such conditions continued until settlement west of the Allegheny Mountains began and transportation developed. When the Erie Canal was completed the New England farmer began to feel the press of competition from the west. A little later the railroads extended into the west, and then the New England farmer found himself hard pressed.

Just about this time the reaper, the mower and the steel mouldboard plow were invented. The western farm was large, fertile, level, free from stones, and admirably adapted to the use of machinery. One of these western farmers could produce under such conditions three or four times as much beef or pork or mutton or hay as could the New England farmer on his little farm. The New England farmer was not in a position to utilize these improved methods to full advantage. These western farmers made food cheap, and that made it possible for the cities to grow.

The New England farmer naturally drifted into manufacturing when agriculture became unprofitable, and this region became the manufacturing center of the country.

The growth of the cities based on this manufacturing did two things for the farmer, — first, it took his children away to work in the factory; and second, it made a market for fruit and vegetables, poultry and dairy products and hay; all of which, with the exception of hay, are the products of intensive farming, and are either bulky or perishable, thereby adapted to production on farms near the point of consumption.

The New Englander had to give up the production of beef, pork, mutton and grain. There was not room for many farmers to go into the production of vegetables and potatoes. Forty acres of potatoes and 30 acres of vegetables are sufficient to feed a thousand people. Neither was there room for all of them to go into the poultry business. But with the rapid growth of the cities it was not long before there was room for all of them to go into the cheese, butter and milk business. So the New England farmer went into dairying, the only intensive form of agriculture available to everybody, while as many as could find a market engaged in producing fruit, vegetables, poultry, etc. In a few localities having special soils such industries as tobacco and onion culture developed; but the rapid development of the west, with its cheap feed, brought competition in the production of butter and cheese. With his bigger farm and cheaper feed the western farmer beat the New Englander at his own game, and along about 1870 to 1880 was another period of hard times; but the farmers' prosperity again returned when the growth of the city was sufficient to take the dairy products in the form of market milk.

In recent years, however, the southern New England farmer has suffered a three-cornered pressure on his major enterprise, — dairying: first, high prices for feedstuffs; second, high prices for labor, in competition with city wages; and third, through rapidly developed shipping facilities, competition in market milk with remote regions undreamed of a generation ago. To these conditions farm management practice of southern New England is not now in full adjustment.

In the economy of such conditions low-producing cows have no place; all dairy herds should be closely culled, though seldom disposed of entirely. Labor distribution becomes of paramount importance. Owing to the fact that the dairy herd demands for its care more men than can be used in growing the crops to feed, more cash crops should be grown. Under the changed economic conditions the old doctrine — that everything grown on the farm should be fed there — is fallacious, and quite often costs the farmer a pretty sum. Chemical fertilizers, when price of the crops grown warrant a liberal application, fully maintain soil fertility. Especially is this true if the crop grown leaves in the soil a considerable residue of organic matter. In southern New England it is always possible to follow a rotation which includes one or more such crops.

The price of a crop in the eastern and southeastern States largely determines whether it depletes or upbuilds a soil. When cotton was around 7 cents a pound its continuous culture in the southeastern States exhausted the soil rapidly. With cotton at 12 and 15 cents, its continuous culture in the eastern part of the cotton belt rapidly builds up fertility. The reason is that the heavy fertilizer application warranted under the higher price produced such a heavy growth of plant as to rapidly increase the organic content of the soil. Present prices of hay in southern New England warrant a fertilizer application which will increase fertility far more than did the old system of producing low yields yet feeding on the farm and returning all the manure that was not wasted.

Many of the farms of southern New England are entirely too small for most efficient operation under the scheme of fewer cows, better cows and more crops for sale. The old proverb about a little farm well tilled was good in this region many years ago, but does not fit into the economy of the competitive system of dairy farming in southern New England to-day.

Southern New England farms in the aggregate are slowly responding to this economic pressure, and are readjusting their farm organization to meet new conditions. A clear conception of just what changes should be made will tend to more rapidly bring about that economic balance necessary to greatest prosperity.

Mr. Atkins. I would like to inquire if Mr. Cates thinks if the men on the 40-acre farms were picked up and placed on the 200-acre farms their income would be largely increased?

Mr. Cates. I do not think it would immediately; they would have to learn the business gradually.

Mr. Atkins. My point is this: isn't it usually true that a man with a large farm is a man of large ability?

Mr. Cates. Well, he is a man with more money too; but there is always the way for the fellow on a small farm to rent and thereby increase the size of his business.

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STATE BOARD OF AGRICULTURE.

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MILK INSPECTION FROM THE PRODUCER'S POINT OF VIEW.

HARVEY W. WILEY.

From the Sixty-third Annual Report of the Massachusetts State Board of Agriculture.

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MILK INSPECTION FROM THE PRODUCER'S POINT OF VIEW.

HARVEY W. WILEY, M.D., WASHINGTON, D. C.

Having looked at the problem of milk inspection for a third of a century from the consumer's point of view, and particularly from the point of view of the official in charge of the execution of food laws, I am appearing in quite a new guise in considering this subject from the point of view of the producer. I have now for nearly two years been a producer of milk, on a small scale, for commercial purposes. The size of the production, however, does not affect the question. During this time my attention has been particularly called to the effect of milk inspection upon the producer. I take it for granted that every producer of milk desires to send to market an article which is wholesome, which does not threaten the life or health of children, and which is as clean as can reasonably be expected. I claim to belong to that class of producers. I think, also, if there be any of another kind of producer still extant, that he may listen with some benefit to what I have to say. I suppose there are producers of milk who send to market products of diseased animals, containing filth and dirt which might well be excluded. In charity I assume that most of such producers are ignorant of the nature of the problem. There can be very few who deliberately send a product to market knowing that it is practically unfit for consumption, and in addition to this that it may threaten the health and even the life of the children who consume it.

Beginning at the foundation, in the selection of a herd I make it an invariable rule not to place in my herd any diseased animal, in so far as ordinary precautions can exclude such, nor any animal that would react to the tuberculin test. I am aware that no human test of this nature can be absolutely correct. There are some animals that are badly afflicted with tuberculosis which do not react to the test, and there may be some animals which do not have any taint of the disease which do react. Allowing for this uncertainty, which, I am told by competent veterinarians who have had experience, affects from 3 to 5 per cent of the animals inspected, we must give to inspection the full value of making it possible to have a tuberculous free herd.

From the point of view of the producer I think it is to our highest interest to secure herds of this kind. Most of the diseases of a bovine character are easily ascertainable by external symptoms. This is particularly true of such diseases as that known as the foot and mouth disease. On the other hand, the tuberculous cow may give no external evidence whatever of infection. In fact, she may appear to be as healthy as any cow in the herd, and yet the disease has taken hold of some of her vital organs and if left to itself will doubtless progress to a dangerous degree.

It may be interesting to know what has happened to my herd in nearly two years, and as a result of three tests by the officials of the Bureau of Animal Industry. Naturally, I expected to have a herd free of reactors. Imagine my astonishment, therefore, when, at the first inspection, 5 out of a total of about 50 tested animals reacted; in other words, 10 per cent. There are two possible reasons for this result, — first, that some negligence or impurity of the serum had made the test which was given the animal unreliable (in this case the animals were suffering from tuberculosis at the time of purchase, and the certificates were misleading); second, that the animals had acquired the germ of tuberculosis at the time of purchase, but the disease had not gone far enough to produce a reaction. I eliminate as wholly improbable the possibility of plugging, which is sometimes, I am told, practiced to deceive the purchasers of bovine animals.

At the second inspection, which took place at the end of about nine months, four additional animals reacted, and three were quarantined as suspicious. At the end of two months these three animals were again tested, and two reacted and were condemned and one was found free of reaction. The total number of animals inspected at the second inspection was 87. To recapitulate, of 87 animals which I have had tested for tuberculosis 11 have been condemned. One segregated as a suspect was found, on a retest, to be free of disease. It is only proper to say that of the total number of 87 which were inspected, a large number were heifers that had been born on the place or purchased as young heifers, and were tested for the first time. None of these heifers reacted, so the total reactors were among about 60 purchased animals, which makes the percentage of reactors still larger. Another interesting point is that of the total number, 11, condemned out of the purchased herd of about 60, 7 were from a purchase of 10 animals at one place and only 4 were found among the other animals purchased, about 50 in number. On laying these facts before a competent veterinarian he said there was no doubt of the fact that there was a general tuberculosis among this herd which was not sufficiently developed to give a reaction at the time of inspection and sale, and which reacted in only 5 of the animals at the first inspection after they had been on my own farm for about three months. This fact shows the great circumspection which a dairyman should exercise in the purchase of animals subject to the tuberculin test. He may get hold of animals, where there has been perfect good faith between buyer and seller, which speedily develop the disease, and thus become practically a total loss.

My experience, of course, is of such a character as to lead me to be more firmly convinced than I ever was before of the fact that when men honestly endeavor to secure animals free from a disease of this kind and fail, it is not quite in harmony with the principles of justice to expect them to bear the whole loss. The elimination of tuberculous animals from a herd is for the benefit of the community as well as of the owner, and the community should bear a part of the expense. I think that if it could be arranged so that the State or the nation could pay three-fourths of the value of the animals slaughtered, an equitable plan of adjustment would be secured. In other words, the owner of the animal would suffer one-fourth of the loss, and the community, for whose benefit the inspection was made, would pay for three-fourths of the loss. During the whole time of my service with the government I was strongly of the opinion that the farmer should not bear the loss of diseases of this kind caused by official act. It is bad enough to bear the losses from hog cholera and other incidental diseases, but when animals are destroyed by order of the nation or the State, for the protection of the public at large, the case is quite different, and the producer has the right to expect a reasonable compensation.

One of the great problems which the producer is soon to face, and which he is now facing in many cases, is that of refrigeration. In view of the fact that a high temperature, that is, above 50° F., promotes the rapid deterioration of milk and an enormous growth of the bacterial flora, it is reasonable on the part of the consumer to require that milk should be delivered at a low temperature. Not only should milk be delivered at a low temperature, but it should be reduced to a low temperature immediately after it is withdrawn from the udder. In other words, the milk producer must be provided with some method of refrigeration. In the north, where abundant ice crops are produced, it is not difficult for the dairyman to handle this problem in the way of providing an ice supply. In my locality, where the winters are usually so mild that ice is not formed in sufficient quantity for preserving, and where the summers are hotter and longer, the problem is one of great significance.

At first I tried to solve it by using the water of a mountain spring, the temperature of which is normally about 55°, but which in summer, by piping and otherwise, rises to about 60°. As soon as the milk is secured it is cooled by passing over a cooler through which this spring water is flowing. The milk is thus secured at a temperature, even in summer, of about 60° as a rule. This, however, is not sufficient for the purposes of the consumer. It will be necessary, in the south, to provide some artificial refrigeration by means of which the temperature of the milk can be greatly reduced below 60°. In fact, it ought to be reduced to 40°, and can be with a good system of refrigeration. If milk is reduced to 40° and then shipped in a double can, the space between the two cans being filled with dry air, it can be sent many hours on a journey without any threatening rise of temperature.

I have secured a number of bids from manufacturers for installing a refrigerator of this kind, which is to be run with steam power. For a small dairy such as mine, where the production of milk is not likely to go over 200 or 250 gallons a day, even when the herd is filled to its maximum, I find that the installation of an effective refrigeration of this kind will cost at least a thousand dollars, and the additional amount of expense for fuel for running the compresser three or four hours a day will amount to a considerable sum. Unless the producer can get a better price for clean, cold milk from disease-free cows he is going to be engaged in charitable work. Ordinary market milk from common herds, drawn in the ordinary way, brings, in the Washington market in the summer, about 16 cents a gallon, out of which the producer must pay $2\frac{1}{2}$ cents per gallon freight. The sale of pure, clean, cold milk at $13\frac{1}{2}$ cents a gallon is not possible if the dairy is run on business principles, as it should be. From the point of view of the consumer the public should be taught to pay the extra price for milk of this kind. Otherwise only producers who are wealthy will be able to remain in the field. There is a milk sold in Washington, certified and at a low temperature, at 20 cents a quart to the consumer, while the milk that brings the producer $13\frac{1}{2}$ cents a gallon net is sold to the consumer in the summer at about 8 to 9 cents a quart.

It is not the part of this paper to discuss the profits of the middleman. What I am discussing is the necessity for the producer to get a larger amount for his milk. If the producer in our part of the country could look forward to a year's market averaging 20 cents net per gallon, he might possibly be able to make both ends meet and produce clean and cold milk. There should be, therefore, a campaign of education, as well as some method of identification which will lead the consuming public to pay a reasonable price for good milk. I consider the problem of proper refrigeration one of the most important to the producer in the southern part of our country. How can I emphasize, more than has already been done, the necessity of cleanliness? That milk cows should be clean goes without saying. That their udders should be washed and dried is an accepted proposition. That the hands and clothing of the milker should be clean every one admits. That the utensils holding the milk should be sterilized after every use is acknowledged by all. That every possible means of excluding dust and dirt should be used no one denies. In spite of all this knowledge, however, on the part of the producer, and in spite of a reasonable effort on the part of many producers to secure conditions of this kind, it is not always possible to see them fulfilled. As a producer I should say that he should do all these things, or else look to another line of agricultural activity for his support.

I think you will gather from what I have said above that I have not changed my views in regard to the milk problem since I became a producer. I have only changed my point of view. I want the producer of milk to be regarded as a friend and not an enemy of the community. I want to see the stigma which attaches to the milk trade removed. I want to live to see the day when the man who makes beer cannot truthfully go before an audience, as he can now, and offer a sterilized, clean product, and compare it with the ordinary milk which the consumer buys, with no praise for the milk. I want to see a sentiment in this country which will compel the keeping of disease-free cows in a sanitary way, and at the same time a generous support of the men who do this, so that they may come out at least without financial loss in their efforts to serve the community. Milk is the most important of our foods because of its necessity for the infant and the child. We must protect humanity in its tender years. We must have pure, clean, wholesome milk. We producers must make this kind of milk. You who are consumers must pay for this kind of milk.

The Commonwealth of Massachusetts.

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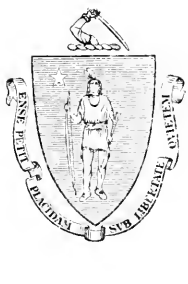
UTILIZATION OF SURPLUS FARM PRODUCTS.

H. F. HALL.

From the Sixty-Third Annual Report of the Massachusetts State Board of Agriculture.



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UTILIZATION OF SURPLUS FARM PRODUCTS.

H. F. HALL, AGRICULTURAL EXPERT FOR CAMPBELL'S SOUP COMPANY, CAMDEN, NEW JERSEY.

The matter of holding or preserving perishable farm products during a season of plenty and low prices to be used during times of scarcity and higher prices is a question of very great economic importance not only to the farmer but to the consuming public as well. Large quantities of food are annually allowed to waste because the market price will not cover cost of harvesting and marketing. By many it is claimed that cheaper and more direct methods of distribution, thereby enabling the consumer to secure his supplies at such a price as to encourage greater consumption by him directly as a substitute for the higher priced commodities, together with the tendency of the consumer to buy during gluts and do his own canning, would solve the problem. This would doubtless have a great influence but for the present-day tendency of the consumer to order his food supplies in cans rather than to buy the raw material and go to the trouble of home canning. In fact, the present-day method of the consumer to have his goods delivered in a "ready-to-eat package" is doubtless one of the principal factors underlying the cause of continued gluts.

The buying public no longer seeks the farmer's wagon to buy at first cost and carry home in a hand basket the vegetables and fruits needed for home consumption. For this reason, public retail markets in most of our large cities have proven a failure, and while the consumer often complains of high cost of living, he perhaps forgets that his method of ordering goods delivered in small quantities and taking thirty days for payment has an important bearing upon the cost price. This would indicate that an efficiency movement is needed to impress upon the housekeeper the importance of better methods of supplying the home table. Our experiment stations and various agricultural and horticultural societies have devoted their energies for many years to the subject of increasing production, but old methods of marketing and distributing crops have gone on undisturbed. In what way is the farmer benefited by large crops if they are allowed to rot on the ground for the want of a distributing and selling system that will turn back to the grower a fair profit after transportation and selling charges have been deducted?

If our farmers were thoroughly organized they could by advertising relieve a congested market by informing the public of the facts, urging them to buy, and recommending ways of cooking and using the surplus crop as a substitute for higher priced commodities, and the advantage of home canning to hold for future use.

During the past season New Jersey fruit growers were buried with an enormous crop of peaches, and prices promised to be below cost of picking and marketing. The horticultural societies caused to have posted on farmers' wagons and in other conspicuous places colored posters, urging the public to buy and use peaches on account of the low prices at which they could be bought. By those in a position to know, it was claimed that this work played a very important part in moving, at a fair price, the surplus crop of peaches.

The home hamper as a means of the grower's supplying the consumer direct is a method of interest only to the small grower, and does not promise to become a matter of general importance in affecting this question.

When located near a large city the grower often finds it to his advantage to hold his surplus produce in cold storage, but when located some distance from a market he will usually find the commercial cannery, in case one is located near him, his best buyer. The particular objections to artificial refrigeration are storage charges, shrinkage and cost of handling. These changes combined often run so high as to make the venture an unprofitable one.

Very few preserving establishments are found in New England, the principal ones being the corn canneries in Maine. Such establishments could doubtless be induced to locate in Massachusetts if the farmers in any particular locality would guarantee the required acreage of any of the important farm crops now used in commercial canning.

The total number of canneries in the United States is about 4,000. Amount paid by canneries for raw material is over $100,000,000 annually. Total value of finished product is $157,000,000 annually. In this industry Massachusetts has played a very small part. Some of its canned products include pears, quinces, raspberries, strawberries, tomatoes, pumpkins, squash, rhubarb and spinach.

A well-ordered general canning concern is usually a great help to any community, provided the growers produce a variety of vegetables and fruits at such seasons and in such quantities as to keep the cannery operating at least five or six months during each year. The canner must have the continued co-operation of the farmers through good and bad seasons, as most canners find it necessary to sell their product before it is put in the can. In fact, a future sale is often made by the canner of a crop long before the farmer is ready to begin harvesting it. It is, therefore, apparent that the canner cannot depend upon the surplus products during times of glut for his supply.

Most canners contract in advance a sufficient acreage of different crops to meet their needs. Prices paid are usually somewhat lower than the average market price on graded and well-packed goods, but are much higher than prices during times of glutted markets. By contracting in advance the farmer is sure of a fair price for his goods, and eliminates that element of chance from his work.

Another important feature is that there is less work in preparing vegetables and fruit to be delivered to a cannery than is the case when prepared for market. This is very apparent in such crops as beans and peas, which instead of being hand picked may be cut like grass, and delivered to the factory where a vining machine does the work of shelling and separating. Labor-saving methods of handling farm crops are worthy of careful consideration as the farm labor problem becomes more serious.

The following crops are extensively used in canning and can be grown successfully in Massachusetts: string beans, beets, sugar corn, peas, pumpkins, cabbage for sauerkraut, rhubarb, spinach, tomatoes, mushrooms, squash, hominy, dandelions, cauliflower, cucumber pickles, pickling onions, apples, blackberries, blueberries, cherries, peaches, pears, plums, raspberries and strawberries.

The following are the usual prices paid by the canners for goods delivered at their factories: cabbage for sauerkraut, \$10 per ton. Sugar corn, from 2 to $2\frac{3}{4}$ cents per pound for corn cut from the cob, or \$15 to \$20 per ton for the ear in husk; cobs are usually returned to the farmer and have a value of about \$3 per ton for fertilizing purposes; gross returns of this crop to the grower, \$50 to \$100 per acre. String beans, price $1\frac{1}{4}$ to $1\frac{3}{4}$ cents per pound; gross returns of this crop to the grower, \$75 to \$125 per acre. Beets, \$13 to \$15 per ton; average yield, 4 to 8 tons per acre. Dandelions, \$10 per ton. Pumpkins, \$5 to \$6 per ton; average yield, 8 to 12 tons per acre. Rhubarb, average price \$10 per ton. Spinach, \$10 to \$20 per ton; average yield, 5 to 7 tons per acre. Squash, \$10 per ton; average yield, 5 to 10 tons per acre. Tomatoes, \$9 to \$10 per ton; average yield, 8 to 10 tons per acre. Apples, 75 cents to \$1.50 per barrel; second grades can be used for this purpose if free from wormy stock.

Farmers' co-operative canning associations have been formed in many sections of the country, but unfortunately have seldom proved a success, usually due to a lack of close co-operation among the members and a tendency to sell their crops through other sources during high prices.

Home canning has been tried by many farmers as a means of disposing of their surplus crops, but thus far has met with rather indifferent success, owing to the cost of operation and the variable quality of products when canned. The home-canning outfit can be used to advantage in caring for surplus vegetables and fruits that would otherwise go to waste. Such operations are entirely practical for the home supply and perhaps a small local trade, but the idea of large profits from such an enterprise when these products are sold in the open markets is usually misleading.

The labor cost of canning on the farm is much greater per unit than is the cost in the factory where large automatic machinery is used for the various operations, unless the farmer can do his canning work at odd times, when his labor is not otherwise advantageously employed. The quality will not average as high or as uniform when canned in the home, owing to the lack of modern means for proper sterilization and testing.

The process of drying has been employed to a certain extent in this country in the case of fruits, and in Germany with some vegetables, notably the potato, from which potato flour is made. Our government is now experimenting with the potato for this purpose, and it is possible that in the near future potato flour will be made on a commercial scale in this country.

Denatured alcohol can be made from all farm products containing sugar, but this work has not met with any great degree of success as yet, as the price that could be paid for farm products when used for this purpose would be in many cases below the actual cost of harvesting and delivering to the distillery.

The potato, on account of the large amount of starch it contains, is the most desirable farm crop for alcohol making. At the present prices of denatured alcohol the distiller would be able to pay the farmer about 12 to 15 cents per bushel for potatoes. This industry, therefore, affords the farmer very little relief in the way of a market for his surplus or crops of No. 2 quality unless the price of alcohol increases materially.

QUESTION. How far are the children benefited through better canning laws in the United States at present?

MR. HALL. The child labor law in the different States varies considerably. No doubt in many cases the reforms were necessary.

QUESTION. I mean in general, because it has been such a terrible scourge in our country that children were allowed to work sixteen and seventeen hours a day in canneries.

MR. HALL. There are doubtless cases where minors work long hours in can-houses during the rush of the season. Such seasons usually last but a few weeks at the most, and as the wages paid are generally on the basis of piecework, the laborers are anxious to make as much time as possible. The work is usually done during summer and fall, when the factories are well ventilated and the health of the employees good. However, the labor laws in some States have corrected any abuses that may have existed by establishing the number of hours per week a minor may work in such factories.

QUESTION. That is exactly the point; it seemed to me a few years ago that things were not brought up-to-date as they should be, because for every child that is not given an opportunity it means so many more for our hospitals and everything that goes with it. All these men and women interested in this question, if they would all band together on that thing, they could get laws throughout the United States by which more than eight hours could not be demanded of any child for the sake of any father or mother.

MR. HALL. In this matter as in that of any other reform, we are liable to go too far when attempting legislative reform. In determining the number of hours a minor should be allowed to work it is necessary to know the nature of the work and conditions under which it is to be done. By many it is believed that healthy children from fourteen to fifteen years of age who will not attend school may be much better employed for a reasonable number of hours per day at light work in a well-ordered and ventilated factory than to spend their time walking the streets or in an ill-ventilated moving-picture theatre. We do not employ children in our factory or upon our farms.

MR. DONALD MCRAE of State Farm. I should like to ask the speaker if he knows the process that potatoes go through in making potato flour? Whether the potatoes are just evaporated and ground, or whether they are cooked first and then evaporated and ground?

MR. HALL. I am unable to answer your question. The Department of Agriculture at Washington is at present interested in this work, and is now prepared to send out samples of this material. They have not as yet published any details concerning the most approved methods of the process. We know that this work has been carried on in Germany for some time, and that its future depends upon the price at which potatoes may be bought, as well as upon the price of cereals from which flour is usually made.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 59.

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RURAL CREDITS.

MYRON T. HERRICK.

FROM THE SIXTY-THIRD ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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RURAL CREDITS.

MYRON T. HERRICK, CLEVELAND, OHIO.

I feel in speaking on this subject which, from the merest statement of it, is more or less dry, that I should endeavor, so far as I am able, to qualify a little before I attempt to instruct. I do not really mean to attempt to instruct, because I feel incapacitated for doing that. I feel almost like apologizing for attempting to speak on a subject which so many people know so much more about, but that is not the way to learn about a subject. If you attempt to tell somebody else about it you are obliged, from time to time, to know something about it yourself, and finally you accumulate some little fund of knowledge. A great many years ago, more years than I wish it were, I was a small boy on a farm, and I think I got my first lessons about land credit there. I heard my father and mother speaking of the maturity of the mortgage on the farm. It was held by one Mr. Gunn. Mr. Gunn held several mortgages on the farms in that community, and he had a way of not letting the owners know exactly whether or not he was going to renew those mortgages until near the time. All through that neighborhood — it was a thrifty one — the people could accumulate a certain amount of money over and above that necessary for the support of their families, but under the system of a mortgage falling due in three or five years — a system which still exists — it was not possible to recover from those little farms money enough to pay up the entire sum from the land; therefore these renewals. I remember that that was the very first trouble I had in the world. I heard this discussion, — whether or not that farm would have to be sold because they couldn't pay it unless they could get a renewal. The farmer is rather inclined to think that the man who has the mortgage on his farm wants his farm. He does not, as a rule, but at the same time it appears so to the farmer. Now the mortgage was renewed and time went on, but years after, when I became the head of a savings bank, I began to consider this question and to try to understand why the decline had come in agriculture in our prosperous State of Ohio. It then occurred to me that that very influence of not being able to finance beyond three or five years must have a retarding influence in developing the resources of the farmer's land. I believe that just that fact, that the mortgages fall due within three or five years and that the principal cannot be recovered, as a rule, out of the land during that time, is a retarding influence on agriculture in the United States.

The rural-credits movement has two separate and distinct objects: (1) to introduce long-term mortgaging for loans on farm lands; (2) to encourage co-operative banking among farmers. At least these were its original objects. The auspices at the start were propitious. Indeed, they could not have been brighter, since three presidents in succession and the largest political parties indorsed the movement and the entire country united in giving it godspeed. But now public opinion is divided, because the first object has been made the pretext for wild schemes of government intervention, and the second object has been obscured through a misunderstanding of the principles and purposes of co-operation.

The movement has been converted into a vehicle of experimentation. Enthusiasts on land credit have conjured up the dreams of mobilizing and "coining" the soil, and other vagaries which were obsolete before John Law's Mississippi bubble burst. They have revived plans which were tried out and abandoned in the American colonies prior to the birth of the nation. They have resurrected and unconsciously revamped as their own nearly all the rejected ideas advanced in France during the quarter century preceding her first law on agricultural credit. In scurrying over Europe for models they have passed by the German Landschafts and mortgage banks, the French Crédit Foncier, and other thoroughly tested concerns organized simply for extending land credit, and have imported for adaptation the antiquated institutions which the government some time established for breaking up the feudal system, and the bureaus and commissions which the government has recently established to distribute money obtained or appropriated for ignorant and indigent peasants, or to meet problems arising from absenteeism, city congestion, compulsory military service, land reclamation and interior colonization.

Existing methods and institutions in the United States have been practically ignored. Originality of design, with any defects in that design cured by State aid, appears to be the hobby of the enthusiasts on land credit, and, in confusion of precedents and disregard of actual conditions and necessities, they have elaborated in their minds artificial structures which needs must have extraneous support. So it happens that there is now being proposed for American farmers a general use of government cash and credit on a scale that has not yet appeared in any country. American agriculture does not call for such aid, but these things do, since without it the chances would be slight of their ever being patronized by the farmers or the investing public.

As respects co-operative banking, the enthusiasts have overlooked the eminently practical character that it must maintain, have exalted it into altruism, and have demanded for it far more than the guiding hand and assistance of the government. They have gone even beyond the idea of charity and almsgiving, have forestalled the millennium and appealed to a sublimated spirit of self-abnegation and brotherly love. They have conceived utopias in which human instincts and personal ambitions may be suppressed, and the elysian fields may be cultivated by perennially happy farmers, each renouncing his individual good, sharing with his less fortunate co-laborers the fruits of his toil, and devoting his spare time to organizing co-operative societies in which producer and consumer, bondholder and mortgagor, lender and borrower, creditor and debtor, all may live and work in harmony, enjoying the best prices on purchases and sales, and granting or receiving loans from money obtained on their collective guaranty as cheaply as the United States government can secure funds, or at rates always lower than those current in the market.

These appeals to altruism and demands for special privilege, class legislation and State aid have belittled the purposes of the movement and retarded its progress. Co-operative banking is of no use to farmers when it is made benevolent, or when its functions are restricted exclusively to saving and lending. It is not practiced successfully among farmers except where it is used in a very practical manner as a financial instrument for organization and for strengthening the member's purchasing and selling power. As a result of the narrow scope given to co-operative banking by the so-called "credit union" laws, unfortunately enacted in some States and by the majority of superficial investigators who have studied the subject, American farmers have not taken kindly to the idea, and rural co-operation is no farther advanced than it was five years ago when the movement first began.

Altruism and State aid are not the only burdens that are impeding the movement for land credit; it has been almost swamped by projects foisted upon it with no consideration of their probable effect, except upon the class of persons whom they are intended specially to benefit. Nearly all these projects relate exclusively to agriculture. They propose either government intervention or the adoption of some new and untried scheme, with little regard to the fundamentals of the problem or to the consequences on other industries. This is true of the bills in Congress and also of the laws enacted in the States, while the latter have the additional objection that they differ one from the other and prevent a standardization of the farm-mortgage business.

One of the manifest causes of the present financial troubles of agriculture is a deficiency of good general laws on both land credit and co-operation. The lack of such laws is felt by many persons besides farmers, and it would seem that some legislator might have suggested that the first step should be to remedy defects, supply omissions and enact general laws based on correct principles for the good of all. This is the natural course of legislation on new subjects, but no one appears to have thought of it. The idea of a general reformation has been condemned without a trial, and the solution of the problem has been made unnecessarily difficult by treating farmers and owners of farm lands as if their needs conflicted with the interests of the rest of the people and must be supplied through special laws and means.

The shortcomings of American agriculture are traceable to the facts that the farmers have not combined their resources with the view of helping one another. Their greatest need is more co-operation. This can be brought about only through a more extended and intelligent use of the association. The associational form of organization is the best for agriculture in every one of its phases, whether it be for business, finance or social life. The problem would be simplified if this were kept in mind. The legislative steps that might be considered are —

1. An amendment of the national banking act so as to permit any national bank that confines its credit facilities to members to be organized as an association without capital stock.

2. An amendment of the banking act of each State so as to permit any kind of bank that confines its credit facilities to members to be organized as an association without capital stock.

3. A law by the nation and in each State to legalize for associations whatever is lawful for corporations, *i.e.*, a regulatory law.

4. A clause in such law to permit combinations among farmers' associations or small producers' or consumers' associations.

In the first place my desire is that the associational form of business shall be extended throughout the communities of this great country of ours and perform a service that we cannot perform in any other way — that is so great we cannot begin to comprehend its benefits and effects. The mutual life insurance companies are highly successful examples of this form of organization. Take another example, the Associated Press, which I will compare to the Landschaft in its operation, because it does not enrich itself, but it performs a service. The Associated Press of the United States, which, by its organizations puts the news down at our doors every morning for a small sum of money, performs an enormous service but does not grow rich; it does not accumulate a great capital, but it serves all the newspapers and makes their business of publication possible. That is service that is performed by an organization, and it is comparable to the Landschaft, which performs a service, and has, throughout some twenty-seven countries abroad, and has accomplished results comparable to those of which I speak. It is along that line that we want to seek to develop the agricultural resources of this country by the associational form of service of the two kinds to which I referred. I would not confine it to that, but I think that the greatest opportunity for development, the best adapted to agricultural interests, is the associational form. I believe in the incorporation of great institutions like the Crédit Foncier and those of a similar character, and I think that we probably need some national legislation along these lines; but for the associational form of legislation I believe this would work, — an amendment of the national banking act, so as to permit any national bank that confines its credit facilities to its members to be organized as an association without capital stock. We have got a national banking act, so to the extent that you will allow an association under the inspection of the government, an association may be formed like the Landschaft association, which is comparable, as I said, to the Associated Press organizations and serves a great community.

I know that most of you know the meaning of a Landschaft, but if you will permit me I will take the liberty of explaining its meaning briefly because it is through that kind of organization that I hope we will be able to work. We will suppose the State of Massachusetts passes a law which allows organizations of farmers for the purpose of borrowing and for the purpose of marketing and selling in different districts that are divided off into townships and counties. Now, if a group of men want to borrow money and there is no money in that township, the men who want to borrow will find that an association may be formed consisting of a president and a secretary and a treasurer, and that organization will consist of all the men in that township who want to borrow money. They all come and make a mortgage to that institution, and that Landschaft, instead of giving them any money, gives them bonds running over a period of years in return for the mortgage that they give to that association. Now you will say, "What good will that do the farmer who wants to borrow money?" It does just this: that man receives his bonds, and these are negotiable in the open market. He may make a loan for five, ten, fifteen, twenty-five or even seventy-five years, in which he pays so much of the principal and so much of the interest in the shape of annuities. As an example, I saw this instance of a loan that had run seventy-five years. I give this, because it is extreme; a man borrowed of the Crédit Foncier $5,000 for seventy-five years. He agreed to pay 4.30 per cent for the money. The obligation was drawn so that he paid 4.40 per cent instead of 4.30; the difference between 4.30 and 4.40 paid the loan at the end of seventy-five years. He paid all during that time 4.40 instead of 4.30, and that slight difference amortized the loan. That is the principle. Now this man receives bonds on which he pays annuities; he has made his mortgage, those bonds are marketable. They can be sold or used as collateral. The societies federate and become collectively liable, and the result is that that security — that bond on which he has financed himself for so many years that he can recover out of the soil enough to maintain his living expenses and pay that loan — becomes a safe and readily marketable investment. The borrower can call the loan and pay it all off if he wants to, but the lender cannot. In other words, the borrower finances his land for a time definite to himself and makes a security that anybody will buy, and they sell against government bonds in Italy, Germany and France. It is not any theory, it is a practice economically sound that has been worked out in those countries. The government should inspect it, umpire it, look after it to see that it is honest.

Second, we should have an amendment of the banking act of each State, so as to permit any kind of a bank that confines its credit facilities to the members to organize as an association without capital stock, in the same way as we have done with the national banks.

Third, a law should be enacted by the nation and each State to legalize in associations whatever is lawful for corporations. We didn't know anything about a corporation a hundred years ago; now we do everything, almost, by corporations. It is a good form of conducting business, but let us enlarge this associational form, so successful in life insurance companies, so as to include all business. It is a simple thing, gives free scope to the affairs of organizations, and is a proper method of permitting the transaction of business.

Fourth, there should be a clause in each law to permit combinations among farmers' associations or small producers' or consumers' associations. Now allow these to combine as they do in Europe. There they have infinite combinations making stronger the credit. The short-time credit and the long credit combine until they run up finally to the Bank of Prussia, or the Bank of France, and the little fellow finds his note of 100 francs in the Bank of France. It would be a strange thing if a note of $20 of a farmer in Missouri or Kansas landed in a city bank of New York; it would be lonesome, but there are hundreds of millions of dollars of short-time financing paper that lie in the vaults of the Bank of Prussia, the Bank of Italy and the Bank of France. This system has the effect of leveling the credit all over the nation. In America, in one place you have cheap money and in another place it is 10 or 20 or even 100 per cent. With a proper system and the land and the proper machinery it is entirely possible to vitalize that credit and mobilize it and increase many times the business of this country and the development of it, and at the same time not break up the existing credit system by leaning on the government to do it. It can be accomplished infinitely better in these other ways.

The rage for innovation and the confusion which it has wrought in land credit arise perhaps from the fact that little effort has been made in the movement to distinguish one from the other the different kinds of institutions devised for organizing land credit, or to study the purpose, merits and results of each kind. The organization of land credit means the substitution of specially designed institutions for individuals as money lenders. Such institutions are of only five kinds: (1) companies for insuring or guaranteeing titles or mortgages; (2) building and loan associations; (3) Landschafts; (4) bond and mortgage companies; and (5) public or semi-public banks or establishments.

The loan transactions of institutions of the first type are largely brokerage; of the second, direct investment of their own funds. Institutions of the third and fourth types issue bonds or debentures; and, since the bulk of the loans is made through this method of finance, they tend to act as mediators between investors and borrowers, and so are the best organizers of land credit. Institutions of the fifth type also may issue bonds or debentures, but their security and financial support lie rather in the connection with government than in the value of the land; they serve to facilitate the distribution of subsidies, usually among some particular class of persons, and so their effect on the general and proper organization of land credit is slight. Included in this last class are most of the institutions for reclaiming land by embankment, drainage or irrigation; these are always localized.

Illinois has one of the best laws, something quite like the Landschaft, and that is this: on the Mississippi River there are great areas of land which are sometimes flooded. It was not fair to make the State pay for reclaiming that land for the benefit of the individuals who owned it, so Illinois has enacted laws by which drainage districts are constituted, and this plan is patterned largely after the Landschaft. They have those great drainage districts and build the embankments and drain the land, and the obligation rests upon that district, which is partitioned off by the law of the State, like a Landschaft. They use the taxing machinery of the State to collect the installments of interest and principal and to meet those loans. Now they did not need the help of the government to institute a bank to take care of that; all they had to do was to make that law and make it possible to create those securities, which was a collective obligation upon that whole community, and they sell immediately in the market at a fair price. It would have been absurd for the State of Illinois, or any of those States, to start a bank to buy the securities, because they would say, "That can't be done unless the State advances the money." All they have to do is to give character to the security.

In no country do land-credit institutions, no matter how few or how many, monopolize the business; all they can do is to supplement the work of other agencies. The real-estate mortgage is so popular that it goes everywhere. Nearly all savings banks and life-insurance companies maintain departments for investing their own funds in it, while many trust companies and other corporations acquire it to hold or to sell. The operations of such investors, brokers and agents would be more extensive if the laws were better. Hence, legislative reform ought not to stop with the creation or authorization of land-credit institutions, properly so called; it should continue until the laws relating to land credit are perfected for money lenders of all kinds, individual and incorporated.

Companies for insuring titles and guaranteeing mortgages, by standing good for the borrower's ownership of the mortgaged property or for the repayment of his loan, are very serviceable in mobilizing land values, but these institutions are not of a pure land-credit type because their guaranty rests upon personal credit. Moreover, as they have more nearly reached perfection in the United States than in any other country they need not be discussed here.

But the laws are defective or lacking in respect to the other institutions. Building and loan associations have attained a great development in the United States; in fact, far greater than in any other country. They are, however, thrifty societies, and not well adapted to agriculture. The recent attempt in a number of States to convert them into credit institutions for farmers has, in my opinion, done harm.

Bond and mortgage companies have reached enormous development in the cities. Most of them are safe and sound, yet they all appear to be operating under defective laws. In Europe these institutions sometimes are called land-credit banks, or mortgage banks. They are subject to rigorous inspection under laws in all the best of which I find two basic clauses. The first is that capital stock and surplus must be maintained at a safe ratio to bonds; this is usually $1 to $20; the second clause is that bonds in circulation must represent first liens on lands of adequate value and never exceed outstanding loans either in amount or in interest rate. I believe that if the States would incorporate these two clauses and provide for proper inspection there would be no question as to the soundness of institutions of this kind. But none should be allowed to do long-term mortgaging unless it has a large capital stock. No investors will deal with small concerns that place their funds out in long-term loans.

Public or semi-public institutions operate with the cash or upon the guaranty of government. Usually (as I said before), they are established for assisting indigent and ignorant peasants, or else for carrying out some national policy. None in recent years has been established in a foreign nation for any other class.

The solution of the land-credit problem lies in the introduction of the Torrens system for facilitating the proving of titles, in the simplifying and standardizing of the laws for recovering defaulted loans, and in the enactment of proper legislation for bond and mortgage companies and for Landschafts. The latter institutions are entirely agricultural, and are considered to be the best means for finding long-term credit for farmers.

You know, after this land mortgage craze in the west some years ago, to ward off the eastern mortgage holder the equities of redemption were deferred, and some two or three years were allowed by which the man, if he got the money, could come back and redeem his farm, and all sorts of obstructive laws were passed which tended to prevent the foreclosure of mortgages. Those laws ought to be wiped out. It is necessary to clean up the real-estate situation in many States before it is safe to operate in this large way with a large incorporated institution. Some fourteen States have the Torrens system. I think Massachusetts is one of the States that has that system. In other words, we are just at the beginning of something in this country which is of such importance — of such transcendent importance to all of the people — that while we are considering the questions of the day we must not permit this one to go wrong; and it has been very greatly in danger of doing so. Had the Hollis-Buckley bill passed in the last Congress I believe it would have been a great detriment to this country. If we can only wait long enough to appreciate the meaning of starting right in the organization of these institutions we shall accomplish something very great for the United States. Those institutions which have worked out and have performed the service in Europe for which they were created have been those which called for the development of individual initiative and resources along these lines of co-operation. It has been said that we cannot do these things as they can over there, — that we cannot establish these institutions. That is tantamount to saying that with the high order of intelligence of our population we cannot do the things that the ignorant peasantry of Europe can accomplish so successfully. It is absurd. We can accomplish it here, and it is necessary for us to do it and to do it along the right lines, but I feel that this is important. Over there these systems of finance are devised by the government or by the people in town, and accepted by the people in the country. In this country, where the farm is the breeding place of brains, and where the people who run the government in the cities come from the land, they have been rather independent, and when the man in the town — in the city — attempts to instruct or tell the farmer what to do, he says, "Go hang, I don't need any advice from you." But the time has come in this country when we are realizing that our interests are one in the development of our natural resources. In carrying on this great machinery of government and all its financial system we are realizing more and more its co-operative, its collective thought, its organization that accomplishes these things, and if the chambers of commerce will take an interest, and the farmers will come into the chambers of commerce, and the city men will join some of the country organizations, we can collaborate and bring out a system that is financially, economically and fundamentally sound. If we do this, the next twenty-five years of advance in American rural life is going to be tremendous, because the credit system is as necessary as the track upon which the engine runs for the railway. You may develop education and develop along other lines, but keep the archaic credit system the way it is and the farming communities, the rural districts of the United States, will not come to their own for many, many years to come. It has been kept out of politics so far, and that is one of the encouraging signs of the times, namely, the idea of taking questions which belong to business out of politics and treating them as we must and should treat them, — as business questions. Now just one more word in conclusion. This is the most momentous time in the history of our lives, one time possibly excepted, the civil war. We seem to feel that we are remote here from that great conflagration which is destroying society and civilization. We seem, in a sense, remote from it. Our time is coming later. There will be placed upon the people of the United States a responsibility, a task to perform, — we won't speak of opportunities, — greater than was ever placed upon any people in the world. It is necessary that we talk about military preparedness and all that; that is necessary, but the most fundamental necessity of all is a preparedness of our economic structure, of our manufacturing business, — a preparation by which we may finance everything that we do, that we, as a people, may work in harmony. The time has come when there is a call to patriotism, a call for the American people to respect the obligations of citizenship as almost never before. We should be serious thinking people now, planning out how we are going to perform this service for the world which it almost seems that we are ordained to perform. We are equal to it in ability. We have the resources, both in materials and in men and women; we have the capability; we have the brains; and the only question lies with us whether we can work together and perfect our organizations and perform in an orderly manner those things which are necessary to carry on a great work to its consummation. I am glad that there is this feeling throughout the United States which brings people together, as we are to-night, to discuss these vital questions of human welfare, because they are far-reaching.

The Commonwealth of Massachusetts.

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ALFALFA CONDITIONS IN NEW ENGLAND.

H. W. Jeffers.

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ALFALFA CONDITIONS IN NEW ENGLAND.

H. W. JEFFERS, SUPERINTENDENT, WALKER-GORDON FARM, PLAINSBORO, NEW JERSEY.

Alfalfa has been known and valued for centuries in the Old World. Some fifty or sixty years ago it was introduced into California by way of Chili. It met with favor as a forage plant, and its cultivation gradually extended eastward until all States west of the Missouri River became great alfalfa-growing States.

The western States were well adapted naturally for alfalfa growing; the soils were deep, dry and filled with a large percentage of lime, and rich in mineral fertilizers. The plant became a great boon to the live-stock interests of the west.

Seedings were frequently made through the east, but were generally failures except in a few restricted districts, one notable district being near Syracuse, New York, where there was a terminal moraine deposit filled with fragments of limestone.

Until quite recently it was believed that the growing of alfalfa in our eastern States would not prove profitable on the great majority of our farms, but the accumulated experience of the past few years of those who have succeeded lead us to believe that any well-drained land properly prepared by liming and fertilizing will grow alfalfa profitably, and that the introduction of this crop in our rotation will increase the fertility of our farms.

All feeders of live stock who have used alfalfa meal or hay have recognized its advantages, and have felt that it was profitable to feed even if they had to pay $25 to $30 per ton for it. The hay is rich in protein and mineral matter and relished by all kinds of live stock. It will grow better pigs, better young cattle, produce more milk when fed to the cow and more eggs when fed to the hen. There seems to be something about alfalfa that makes it a better food than its chemical composition would indicate. This may be due to the large percentage of mineral matter it contains, or some stimulating element that is not yet understood. The man who sells alfalfa products to our eastern farmer I consider a missionary. He is giving us a chance to prove for ourselves its great feeding value. When once tried we are convinced of its worth, and then it is up to us whether we want to continue to pay from $10 to $15 freight per ton on this valuable food from the west, or whether we shall grow it upon our own farms and save the freight.

We think of alfalfa as a crop that grows spontaneously in the west. From all statistics that can be gathered on the average yields, even in the most favorable localities in the west, our yields in the east show well in comparison. Even down in the great Imperial valley, the hottest place in the United States, the average yield of alfalfa is less than 5 tons per acre. We can grow on our eastern farms a yield between 3 and 5 tons per acre per year, depending upon soil and climatic conditions.

There is no forage crop known to-day that will yield more nutrients per acre than alfalfa. There is no plant that is able to send a taproot into the subsoil as alfalfa. It feeds upon the mineral matter in the subsoil that has lain dormant and useless all these years. It is also capable, as are other leguminous plants, through the bacteria that live upon its roots, to convert the free nitrogen of the air to its own use, making it unnecessary to feed the plant with the expensive nitrogenous fertilizers. It is not only able to produce what nitrogen it needs for its own use, but will contribute fertility to other plants growing with it, or when plowed it will add more dollars' worth of fertility to the soil than it has cost to lime, fertilize and prepare the soil to establish it. Therefore we have a plant that is a winner from every standpoint. It gives us the richest and best kind of food, it yields more nutrients per acre than any other crop, it is a soil builder, and by its use in the rotation our farms will grow richer and richer as the years go by, capable of yielding more bounteous crops. This means prosperity, better homes, better schools, better churches and a better community.

Can we grow it in New England? We can! The fields that are already growing it demonstrate that it can be grown. The accumulated experience of the men here in New England who have already succeeded is enough to stimulate us to put our shoulders to the wheel, study our farms, study the type of our soils and their requirements, and prepare them for the introduction of alfalfa into our farm-crop system.

Any well-drained soil, where the water table is 4 feet below the surface, can be made to grow alfalfa by proper preparation. It will grow upon rough, rocky land, even on soils where the rock is within 2 or 3 feet of the surface, — provided it is cracked and admits of good drainage, — and will send roots down into the very crevices of the rock. Many lands that are not naturally well drained can be made so by the use of tile.

The preparation of the seed bed is of most importance. It should be deep, firm and fine. Our custom is to prepare it after taking off a crop of any early maturing vegetables, grains or even hay, — crops that are harvested about July 1. We then disk the land until the stubble or sod is thoroughly cut up and the soil pulverized. The soil mulch is made for three reasons: first, to prevent evaporation of the soil moisture; second, to hold any rains that fall; third, to germinate grain or weed seeds. We continue to disk and roll until the seed bed is well prepared, or, as soon as the soil is moist enough to plow, it is plowed, rolled and harrowed. By disking previous to plowing the soil capillarity is immediately restored. In some sections in the North alfalfa has been seeded in the spring with a nurse crop of oats, barley, wheat or rye, and good results have been obtained.

The one greatest essential in alfalfa growing in the east is lime in abundance. All our soils, with few exceptions, are acid, and the bacteria that thrive on the alfalfa plant cannot grow; therefore we must put on quantities of lime, whether it be hydrated, burned or ground limestone. If ground limestone can be purchased at a price of a little over one-half what it costs to purchase hydrated or burned lime I should prefer its use. I would spread on the field at least 4 tons of ground limestone per acre, using a lime spreader for this work. It had better be put on immediately after plowing so that the subsequent disking and harrowing will thoroughly incorporate it in the soil.

The next step is the proper fertilization of the soil. Stable manures give good results when put upon the field for the crop preceding the seeding of alfalfa. There are less weed seeds by following this method. Our practice previous to the war was to apply 500 pounds of 2-8-10 fertilizer to the acre just before seeding. Potash cannot be obtained, therefore we are applying 300 pounds of acid phosphate and 75 of nitrate of soda to the acre. Acid phosphate gives us much better results than basic slag or raw phosphate rock. We have demonstrated this by sowing strips with different kinds of phosphate fertilizers. There is something about acid phosphate which stimulates leguminous plants that our chemists do not understand. The nitrate of soda is used to give the young plant a quick start. The plant is weak in the beginning, and by stimulating its growth it will be better prepared to cope with weeds and obtain its own nitrogen from the air.

Seeding should be done at the rate of about 20 pounds of seed per acre. There are several tools for doing this work. If a disk seeder is used it can be sown one way at a depth of one-half to one inch; if the various broadcast seeders are used one-half the seed should be sown each way and then lightly harrowed in, followed by a subsoil roller. Seeding in this climate should be done early in the spring with a nurse crop, or early in August if sown by itself.

The kind of seed to use is of great importance. Unfortunately, the alfalfa seed industry has not yet been standardized so that we can always depend upon the variety or kind of seed we want. For New England, seed should be procured that is grown in the northwest on nonirrigated land, the farther north or the higher altitude from which we can procure the seed the better. Only the hardier varieties can be grown at high elevations or in the far north. Undoubtedly the Grimm is the best variety obtainable to-day. There are a number of new varieties of alfalfa which are being experimented with and which may prove better for New England conditions, but these varieties are not yet grown in large enough quantities to place the seed upon the market.

This summer I spent about a week in the alfalfa seed growing sections in order to study whether we could depend on what these men were saying in regard to seed. I believe there are a few people who are dependable, but they are asking very high prices for their seed. I met Mr. Cooper, the State farm management man, in North Dakota. Now in North Dakota you cannot grow anything but the very hardy varieties, — the varieties such as should be grown here in New England, — and their plan up there is to push the cultivation of alfalfa as rapidly as possible, and they hope in about two years' time to be able to put out alfalfa seed in North Dakota and put a State seal upon it so that you can be assured that that seed is right. I think if the people in the mountain regions of Montana and Colorado and Dakota would do that same thing, and possibly in South Dakota, in the black hills, that we would then get seed that we could depend upon. While I was out there I did everything I could to impress upon them not only the benefit from the seed growers' standpoint, but the benefit it would mean to the eastern alfalfa grower, to get a seed that they could depend upon, because I believe a great many of our failures have been due to poor seed.

In our own practice we select the best seed we can, purchasing from three different concerns, and mixing them together before seeding. If one or possibly two of these strains did not prove hardy and one proved to be we would secure a good stand of alfalfa. All seeds should be inoculated. The government will furnish inoculation enough for small quantities, but the commercial inoculations that are upon the market have proven to be good. The seed can be inoculated at a cost of about $1 per acre, which is cheaper than distributing soil from an old alfalfa field.

After alfalfa is seeded, even if annual weeds appear, it should not be clipped, and if sown early in August should get a growth of at least 8 to 10 inches. If it gets this size it should go through the winter in good condition.

The harvesting of alfalfa is not intricate. It should be cut between the time the little shoots appear at the crown and before they are high enough for a mower to clip them off. The hay should be raked before the leaves dry, and then bunched and capped with canvas. During good weather two or three days after the hay is cocked it can be stored. Oftentimes weather conditions in the east are unfavorable for curing hay, and it may be several days before it can be put in the mow, but the caps will protect it. I have seen hay put in the mow quite green which will go through a fermentation making a dark-colored hay, or what is sometimes known as tobacco-cured hay. This will equal the bright green hay as a feed. What we want to avoid is moldy hay. The hay should be a bright green, or else sap enough left in the plant to produce the tobacco-cured hay.

After the first season it may be advantageous to top-dress with 200 to 300 pounds of acid phosphate, and if the field becomes weedy a thorough harrowing with a spring-tooth alfalfa harrow, or a similar tool, will kill the weeds and stimulate the growth. Alfalfa should always go into the winter with at least 6 to 10 inches of top.

Alfalfa in the crop rotation will not only build up the fertility of the farm, but, if introduced in proper proportion with other crops, a uniform labor load can be maintained which is one of the large factors in economic agriculture.

To those who have not quite made up their minds to begin the planting of alfalfa as a crop by itself I would strongly urge that every farmer use at least 3 to 4 pounds of alfalfa seed in his grass mixtures. For permanent agriculture lime should be used previous to seeding any grass crop, and by the use of lime and thorough preparation of the seed bed and inoculated alfalfa seed in the mixture you will be able to grow better crops of hay than you would by not using the alfalfa. It has been demonstrated that timothy and alfalfa grown together will yield much heavier, and the timothy will be richer in protein, than if grown alone; also by this method, which will be comparatively inexpensive, one can determine the practicability of growing alfalfa by itself. In this way we found that alfalfa grew luxuriantly when sufficient lime was applied previous to seeding.

In conclusion, let us bear in mind these principal points: alfalfa is a highly desirable feed; alfalfa will grow more nutrients to the acre than any other plant; alfalfa will improve the farm; alfalfa can be grown on any well-drained soil by the use of lime, inoculated seed from hardy plants, and can be grown at a profit.

The time is not far distant when the majority of farms in the east will be growing alfalfa. Our lands will be improved, our live stock increased, and we will be able to supply the growing markets in the great industrial centers which are at our very door. We will no longer pay the transportation companies $10 to $15 per ton on our feeds; we will be able to produce more, live better and enjoy prosperity.

QUESTION. What is the general average life of the plant, from your experience?

Mr. JEFFERS. Why, in our own work we are bringing alfalfa into a farm rotation. We are leaving the alfalfa fields till they grow five years, harvest them five years, then two years in corn, then one year in grains.

QUESTION. How does alfalfa compare, from your observation, with the great fields of sweet clover we see in the west, — in Iowa and Kansas?

Mr. JEFFERS. Sweet clover is something that I know very little about. From what I saw there, they were using it largely for pastures. We have never tried much sweet clover, but I should think perhaps it might be well to experiment a little in it, especially if our land is a little poor.

QUESTION. I would like to ask the speaker if he has had any experience with scarified seed? They are using now a machine in the west to scarify the seed so that the germination is increased from 50 to 75 per cent.

Mr. JEFFERS. No, we have not used any of the scarified seed, but I am quite sure that that is very essential to sweet clover. I know we have tried sowing a little sweet clover, and sometimes it will not germinate until the next year. I tried some special alfalfa down in South Jersey with sweet clover, and found that some did not germinate till next year. I think that scarified seeds are very good, especially with sweet clover.

Mr. N. I. BOWDITCH. Mr. President, Ladies and Gentlemen: While the alfalfa growers are together I want to state to them that the oldest agricultural society in the State, — the Massachusetts Society for promoting Agriculture, — in order to further encourage the growing of alfalfa in the State of Massachusetts, through its trustees, offers $600, in five prizes, for the best acres of alfalfa planted in 1916; these prizes to be awarded in 1918, as follows: first prize, $250; second prize, $150; third prize, $100; fourth prize, $75; fifth prize, $25. The trustees will be governed in awarding these prizes by general appearance of the crop during 1917 and 1918. A public weigher's certificate will be required, and all entries must be made on or before October 1, 1916, to General Francis Henry Appleton, secretary, 251 Marlboro Street, Boston.

We would like the co-operation of this alfalfa club in this matter, and any suggestions that any one has to make will be gladly received, because we want to make it as successful as possible.

On motion of Dr. H. J. Wheeler it was voted to extend a vote of thanks to the Massachusetts Society for promoting Agriculture.

Mr. W. P. Nickerson. In relation to the offer of Mr. Bowditch, I am going to start a new field of alfalfa this year, and want to get the $250. There will be a great many who will start fields if they know that the offer is made and if they have some one to show them how to start. They can best be shown and best helped by our county farm agents, and I think that if the farm agents are included in the offer and given full directions, they will increase the acreage of the alfalfa to be grown in the State of Massachusetts very largely. There is just one question I would like to ask, — is this one measured acre that the prize is to be given on?

Mr. Prescott. Yes, one measured acre is the area.

Mr. Nickerson. I would suggest that the alfalfa association ask Mr. Bowditch to notify the farm agents. They are in touch with all the farmers in their counties and can get it started better than any one else.

Chairman. I think notice will be sent around to the people.

Dr. William P. Brooks. There are a few thoughts suggested to me by the speaker's remarks, which I hope may prove of some value. He has spoken of the variety, and I agree with him that too much care cannot be taken to obtain the best possible seed. I want simply to emphasize this point, — that the quality of the seed is not necessarily indicated by the name. There is a good deal of seed offered as Grimm alfalfa, and I know that it is not anywhere near worth the price charged for it as compared with common alfalfa. Now the experiment station is taking the utmost care to get as good seed as it can find, whether of Grimm variety or the so-called common alfalfa, and the two have been tried again and again side by side, and the results have more frequently been favorable for what we bought for common northern grown alfalfa than they have been for the Grimm.

I need not take much of your time, but a few of the figures I would like to read: —

In 1914, in early August, we sowed side by side five kinds of Grimm and three kinds from the Department of Agriculture. In 1915 the Grimm gave $4\frac{5}{10}$; the common, $5\frac{3}{10}$; one of the United States Department, $4\frac{8}{10}$; another, $4\frac{7}{10}$; and one, $4\frac{1}{10}$ tons. I want particularly to speak of that last, — $4\frac{1}{10}$ tons. That was the smallest yield. This variety started off fully as well as any of the others, but it showed itself particularly susceptible to rust, and this emphasizes another point, — some of you have had a good deal of trouble, I know from correspondence, with this leaf spot. This single experience of ours emphasizes the point of which I felt very sure before, but it emphasizes it in a very striking way, — that there may be a tremendous difference in the susceptibility to leaf spot, which always cuts down the yield and kills the roots, and may even ruin the stand. I have other figures concerning the relative yield of so-called Grimm, and when I say so-called Grimm I do not mean to throw discredit on the persons who sold it as Grimm. I have every reason to believe it was Grimm which I bought, after consultation with experiment station directors, of the men whom they said were the most reliable producers of Grimm alfalfa in the northwestern States. I certainly believe I am doing you a service in emphasizing this point, — that it won't pay to give the prices usually charged for Grimm as compared with good northern grown common alfalfa.

As to the time of sowing, just a word from the standpoint of Massachusetts. I think we want to sow a little more than two weeks earlier in the fall than you in New Jersey. In my experience it pays to sow early enough to get a good growth before cold weather. I want a foot or 15 inches of growth. It protects from alternate freezing and thawing, and in every way helps the crop to go through the winter. I have often had it grow so well that it seemed almost wicked to leave it, and I might have been tempted to cut it except that I knew it was worth ever so much more in the ground than if cut. And I should say, from experience in Amherst and from observation in many parts of the State, that we ought to get alfalfa in before the 10th of August, — some time from about the 25th of July to the 10th of August will suit most parts of the State, I think. We have occasionally had good results at the college ground at Amherst in seeding alfalfa in with the corn, but you must not anticipate so perfect a stand, so complete a cover of the ground, if you seed in that way. Yet it is quite possible, and I agree heartily with the speaker, that putting in a little alfalfa seed in ordinary mowing is a good idea, and if in your experience you have found it a satisfactory method to seed the alfalfa with corn, put the alfalfa seed in at that time without hesitation. If I were planning for a crop of clear alfalfa I should not advocate that method of seeding because it is highly important to get the ground completely covered, owing to the grass and weeds and white clover which keep crowding the alfalfa out on many kinds of land.

The question of phosphates was touched upon. This question is one on which, as some of you may remember, I have recently published a bulletin. The bulletin will support, on the whole, the position taken by the speaker. Acid phosphate seems to be a good source of phosphoric acid, and I agree with him that we don't exactly know, perhaps, just why it is so good. Many of you have been attracted, no doubt, owing to the beautiful manner in which Dr. Hopkins expresses himself, and the extent to which he is quoted, to try fine-ground rock phosphates. We have had them side by side for eighteen years with acid phosphates, with basic slag and with various forms of bone, not only one rock phosphate, but all the different kinds, — South Carolina, Florida, Tennessee, — using these phosphates every year in such quantities as to furnish equal phosphoric acid. From the start the acid phosphate was superior to any of the rock phosphates, and the truth is that after eighteen years the acid phosphate's superiority to the rock is greater than it was at the start, — considerably greater.

QUESTION. I would like to ask the speaker, or any one through the speaker, whether there has been any successful experience with alfalfa in New England on a typical granite hill farm, with a subsoil coming pretty close to the top? I hope some little time will be devoted to this side of the problem. I know of cases where it has been grown successfully on favorable soils, but don't know of any where it has been grown on the typical New England hill soil.

Dr. H. J. WHEELER. We have a modest gentleman here who can answer that question, I think, — Mr. Andrews of Vermont.

Mr. EDWARD R. ANDREWS. I will answer that question because for six or seven years I have been growing alfalfa on just that sort of hill land in Vermont. I cannot say that the subsoil is clay because it is not. I suppose the soil is what is called clay loam, that is, it is deep rich loam. It is hard to find the subsoil in many places. There is not any question in my mind but what alfalfa can be grown on these sloping hills. My farm is made up of many of that kind, — not deep slopes, but a gradual slope, and when I first began I made the usual mistakes. I inoculated the seed with the inoculating material furnished by the Department at Washington, and not much was known about it at that time. I wanted to sow the seed right away, so I let it dry in the sun. That did not succeed. Another field that I tried not very successfully was on sod ground, — well, the grass came up and nearly killed out the alfalfa. Yet every year since then — that must have been five years ago — we have cut off a great deal of alfalfa. One year, 1912, I sowed quite a large piece of alfalfa, and that year the ground was bare nearly all winter; no snow was on it, and in the neighborhood of my farm clover was killed out, but my alfalfa was not, and I have had crops from that field in 1913, 1914 and 1915.

I used marl for a good many years which came from New York and cost me $7 a ton, including freight, but last spring a concern was started in Vermont, from which ground limestone could be purchased at \$1.50 a ton, and in my neighborhood it cost me, with freight charges, \$3.50. I used three carloads of that lime on my farm this last summer. I have followed pretty much the plan of getting the land ready that was suggested by the speaker. If you want big crops have the land rich; sow your alfalfa in August, as I do, after a crop which has been highly cultivated. I inoculate everything, — clover seed, vetch, peas, etc. I use "Nitragin," made by the German-American Nitragin Company, at Milwaukee, and have great success. I have used the northern grown seed, and never until 1914 had I time to use Grimm, but in 1914 I sowed a small piece in front of my house, covering 2½ acres, which had been well manured and fertilized, where peas and oats were grown. I sowed one-half of that in Grimm, and since last summer we have taken off that 2½ acres over 10 tons of pure hay. I have had 16 acres of alfalfa this year and I have had 46 tons of hay from it. I sowed about 12 acres more in August.

Last year I got my lime at the low price of \$1.50 a ton; delivered, it cost me a little short of \$2.50 from the lime company at 92 State Street, Boston.

QUESTION. You bought your lime in bulk?

Mr. ANDREWS. In paper bags.

Mr. SANBORN. I would like to know definitely whether any one here has grown alfalfa successfully for a series of years on a hardpan subsoil typical New England hill farm. I care nothing about other details.

Mr. NICKERSON. It has been my pleasure, with immense interest, to pick up alfalfa in front of my house, and never was I more surprised in my life to see the extent of those roots and the size of them. I would like to inquire how you can grow such roots naturally on anything but exceedingly deep soil. What do you consider deep soil?

A MEMBER. I am growing alfalfa on a piece of land where the subsoil comes pretty close to the top. Nothing else grows there, it is such poor land, so I thought I would grow alfalfa.

Mr. NICKERSON. How deep roots do you get?

A MEMBER. I never dug them, but have found roots an inch through. That land was very ledgy, and I planted the alfalfa to go down after that manure and it went down, and I raised alfalfa for ten years. I have seeded it this fall for the fourth time. I have to keep my land moving, but it has grown stronger every time, and it is ten years since I put it in first, and I never inoculated any seed until this last fall.

Dr. Brooks. I notice that the last speaker said his land was ledgy. That would hardly meet the requirements of Mr. Sanborn's description. Way down in southwestern Connecticut I have a son-in-law on a farm where the subsoil comes within a few inches of the surface, and he is having some trouble with alfalfa sown in the late summer of 1914 on a field of 5 or 6 acres, not far from his house. I walked over with him last spring, and we picked up a great many roots where the crown was over 6 inches above the top of the ground. Alfalfa culture under conditions described by Mr. Sanborn is difficult, but perhaps not impossible if there is not stagnant water in the soil. The roots cannot live in stagnant water.

Mr. Prescott. [Exhibiting specimens of alfalfa.] That was grown on a heavy clay subsoil, with a pretty good loam. That was planted the sixteenth day of August and pulled the twenty-first day of September. It was almost 18 inches long when I picked it out. These were grown on sandy subsoil. It is not hilly. The subsoil here is first 8 or 10 inches of loam, then 2 or 3 feet of yellow subsoil turning into a fine white sand, going still deeper into a coarse white sand, and at 11 feet is gravel, with stones as big as an egg. That alfalfa has been growing on that piece of land since 1908; never had any manure since; never been fertilized with any kind of fertilizer. These here [indicating specimens] are two samples of Grimm, picked last summer, which Mr. Wheeler wanted me to bring in. I don't know why they are different in color.

I don't see any reason why we cannot grow alfalfa in Massachusetts as well as we can in New Jersey.

U. S. Bates. I came here with a question in my mind. My own experience has been very small. Until I heard Professor Brooks, I had not encountered any one from whom I could get the information I wanted. He speaks of leaf spot. I suppose that is what is the matter with my alfalfa. I have called it rot and blight. I did not begin until two years ago. I planted a small patch of alfalfa which did pretty well, and I was encouraged to plant again a year ago. I put in only half an acre, but it succeeded pretty well; got a good stand; went through the winter in good shape, and up to July 1 I felt proud of it and invited people to come and see it, but then the blight struck it and lessened the yield. I am wondering what will happen next spring — whether that blight is going to destroy the whole crop. The seed I bought is ordinary alfalfa seed. I did not inquire as to the name or where it came from. I feel a great deal encouraged by the speaker's remarks. I have read all the pamphlets and bulletins and heard all the speakers that have come in my way, and they have all seemed to emphasize promptness and an exact period at which we may cut our crops. They say to wait until one-third of blossoms are out; that we must watch the little crowns at the base and not cut too early, and I had made up my mind that there must be only thirty minutes between too late and too early, and that I would have to get up from the table before I finished my dinner to go out and cut alfalfa; but now I learn from the speaker that we may take a little more time. But what may I expect in regard to my leaf spot?

Dr. H. J. Wheeler. Was that the second crop that had leaf spot?

Mr. Bates. Had it on the second and third crops; the first crop was disease free.

Mr. Jeffers. We have had some of the leaf spot, but not enough to injure a field seriously. I remember one field in particular where we had rainy weather at the time of the first cutting and were delayed about ten days getting the hay off. That field became quite spotted with leaf spot, and it showed in the next crop, but after that it was all right. We thought that was due to running on the field when the shoots were coming up, but we never had enough to be a serious trouble to us.

Mr. Sanborn has spoken of hardpan soil. Where I was born and brought up the hardpan comes up to the third rail on the fence and sometimes they have to move the fence higher to get rid of the hardpan. We have tried out alfalfa on those soils in northwestern Pennsylvania; when you get a real hardpan soil it seems difficult to get the alfalfa to stand a great many years. I don't think alfalfa will ever grow as well on one of those hardpan soil farms as on open, porous soils where it has a chance to get the roots damp.

Mr. Sanborn. I understand roots of Grimm are not like those of other alfalfa?

Mr. Jeffers. If the conditions are the same you will see very little difference in the root growth.

Mr. Prescott. I think I forgot to mention one other thing. Punkatassett Farm, in Concord, has been growing alfalfa on a hill for eleven years. The first piece they put down eleven years ago is on a very clayey soil on a very rounding hill, and they have never had a failure in any way, shape or manner on any of the pieces that they have put down, and I think they have 7 or 8 acres now on that clayey soil which has no sign of a porous subsoil.

Dr. H. J. Wheeler. Regarding what Mr. Sanborn said, I attempted to grow alfalfa for about ten or twelve years with continual failures, all the time working with common alfalfa. After getting hardy types it has been successful. I bought from Professor Hansen of South Dakota a number of plants which I set out in 1912. All have this branch habit, and most of them throw out a number of roots, and that alfalfa has come through every winter since. I don't think a single plant has died. My suggestion would be to communicate with Professor Hansen and get some of the most hardy varieties, and I believe Mr. Sanborn can succeed on the type of soil he mentions.

In regard to this cutting of alfalfa, my experience with leaf spot has been that when it comes on badly you ought to cut that alfalfa at once, no matter whether buds have appeared or not. I would not pay any attention to the state of blooming. If it becomes very dry it may be necessary to cut before buds begin to appear in order to save the crop you have. You generally get another crop, notwithstanding that leaf spot is seen. If you will cut that off at once your next crop will probably be entirely free from leaf spot, but if you leave it you will do a positive injury to the plant. I would like to know what Mr. Jeffers thinks about that?

Mr. Jeffers. I think Dr. Wheeler is right about that. Of course it is a pretty hard matter to lay down any fast rule. I might have the thing in my mind and try to convey it to you and you might get the wrong impression. It is a hard matter to lay down a rule in regard to cutting. You speak of cutting within fifteen minutes of the right time. We take three weeks for our cutting, and we cut just as soon as these buds appear, and during those three weeks we don't destroy very many of the new shoots.

I want to say that one outfit — one mower, one side delivery rake, two or three wagons, and one tedder — is capable of harvesting from 175 to 200 acres of alfalfa, that is, when it is grown in a commercial way.

Mr. Bates. I have found that when I delayed my cutting on account of bad weather, by raising my mowing machine I have avoided cutting the small shoots.

Mr. Jeffers. That is good.

Dr. Brooks. I agree with Dr. Wheeler about the cutting, — the sooner the better, and in many instances the crop will come up healthier the next time; but I want to emphasize again that there is clearly a great difference in varieties in susceptibility. Last summer when one variety went bad, side by side with it, on both sides, on land treated in the same way, other strains were in perfect health, so that the selection of the best possible seed cannot be too much emphasized.

Dr. Wheeler's reference to some of Professor Hansen's varieties leads me to call attention to another matter. We get Professor Hansen's literature, and in the summer of 1914 we sent and got some of his most highly recommended double, hardy, cast iron alfalfa, and it is a miserable failure. Professor Hansen is seeking particularly for alfalfa that will grow where they don't have much loam, and none of his varieties have ever done well with us. They are hardy, they are cast iron, but they don't flourish under the conditions of our humid climate.

In relation to cultures he says you can get small amounts of culture from the United States Department. If alfalfa is new to you use a culture. That advice is absolutely sound, but I am glad to be able to announce that the Extension Service of the college will furnish culture in any amount you need. The charge is a merely nominal one of 25 cents.

I want to refer to a remark made by a speaker in regard to using cultures for clover. I don't believe there is any benefit connected with it. I want to call attention to what clover will do without cultures — without any nitrogen applied to the soil. We don't want to forget in our enthusiasm for alfalfa that clover is still a mighty good crop. We have one field where no nitrogen has been applied to the soil for twenty-five years. That field was in clover last year. In 1913, in the spring, this clover was sown with a thin seeding of oats, and the crop in two cuts, on a plot to which no nitrogen has been applied in any form for twenty-five years, and on which no green manure has been grown and turned under, and without any culture, but with plenty of acid phosphate and potash, amounted to 4.27 tons of well-made hay. On a plot adjoining this where we applied nitrogen every year in addition to the same amount of acid phosphate, potash and lime, the crop was actually a little bit less than it was where we had not applied any nitrogen, — a fact of extreme significance. This shows very clearly that you can raise the best of all forage without nitrogen and without green manure.

Mr. Prescott. I wanted to ask Mr. Jeffers if he thought 75 pounds of nitrate of soda was sufficient to start an alfalfa field with?

Mr. Jeffers. Yes, we feel that it is. I have seen a number of fields started this year and last that were established with nothing but acid phosphate and ground stone, — 4 tons limestone and 350 pounds acid phosphate.

We have one field near us of 50 acres which was established without any nitrate of soda. I think a little nitrate, though, helps the crop along.