MASSACHUSETTS

STATE BOARD OF AGRICULTURE

Circulars 1-30.

1912-1914.

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Circular No. 1

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MASSACHUSETTS STATE BOARD OF AGRICULTURE.

FOOD VALUE OF MILK:

ITS USE AND CARE BY CONSUMERS.

By P. M. HARWOOD,
General Agent, Massachusetts Dairy Bureau.

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FOOD VALUE OF MILK — ITS USE AND CARE BY CONSUMERS.

BY P. M. HARWOOD, GENERAL AGENT, DAIRY BUREAU, STATE BOARD OF AGRICULTURE.

Consumers should use more milk than they now do: —

BECAUSE —

It is nutritious.

It is cheap (even at 12 cents per quart).

It is the best food for babies (mothers' milk excepted).

It should form the major portion of the child's diet up to school age.

The average school child should consume at least 2 glasses per day.

Many adults would be benefited by the use of more milk and less meat.

More milk used in cooking would add the cheapest nutrition of its kind.

Proper nutrition conduces to efficiency and long life, — in other words, to good health.

Good health means better bodies, better minds, better morals, a better community.

Increased consumption demands increased production, thus benefiting both consumer and producer.

Remember: milk is easily digestible without cooking, and that to get the greatest benefit from it milk should be taken slowly.

Consumers should buy —

Clean milk, and keep it clean.

Diseaseless milk and keep it uncontaminated; when in doubt *pasteurize* for safety.[1]

Cold milk, and keep it cold.

Bottled milk only, for babies' food and for drinking purposes.

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[1] Long-hauled milk for large cities is now generally pasteurized before delivery.

The New York Milk Committee says: "Milk-borne diseases are far less common than the underfeeding which results from the use of too little milk." Also: "Milk is a better and cheaper food raw than any condensed milk or any proprietary or patent food." The committee gives the following as to the food value of milk: —

Chemists tell us that one quart of milk is equal in food value to any one of the following list of animal foods: —

	Cents.
$\frac{3}{4}$ pound lean beef at 20 cents,	15
8 eggs at 36 cents,	24
3 pounds fresh codfish at 12 cents,	36
2 pounds chicken at 20 cents,	40
$\frac{4}{5}$ pound pork loin at 15 cents,	12
$\frac{3}{5}$ pound ham at 20 cents,	12
1 pint oysters at 20 cents,	20
Average,	22

Any price expended for a quart of milk buys the same food value that averages to cost 22 cents in the above list. Milk also has greater digestibility and a nearer perfect balance between its various ingredients. No single food-product is at once so nourishing and digestible for both infants and adults.

The United States government says: "The value of milk for nourishment is not as generally understood as it should be. Many people think of it, for adults at least, as a beverage rather than a food, and do not realize that a glass of it adds as much to the nutritive value of a meal as a quarter of a loaf of bread or a good slice of beef. A quart of average milk contains the same amount of nutritive ingredients as 0.75 of a pound of beef or 6 ounces of bread."

Table from Farmer's Bulletin 363, showing Nutrients and Energy in 1 Pound of Water-free Edible Portion of Several Food Materials.

Food Materials.	Protein (Pound).	Fat (Pound).	Carbohydrates (Pound).	Mineral Matter (Pound).	Fuel Value (Calories).
Whole milk,	.25	.31	.39	.05	2,475
Skim milk (0.3 per cent fat),	.36	.03	.55	.06	1,835
Buttermilk,	.33	.06	.53	.08	1,845
Cheese,	.39	.52	.03	.06	2,990
Beef, round,	.57	.40	–	.03	2,750
Smoked ham,	.26	.66	–	.08	3,275
Wheat flour,	.13	.01	.85	.01	1,865
Wheat bread,	.15	.02	.82	.01	1,865
Potatoes,	.10	.01	.85	.04	1,790
Apples,	.03	.03	.92	.02	1,885

Prof. R. M. Washburn, formerly of the Vermont Experiment Station, in a recent lecture before the Massachusetts State Board of Agriculture, said: "In order to compare one food with another it is necessary to compare foods which have a similar nutritive ratio, and are either both of animal or both of vegetable origin, for the digestibility of milk and meat products is very materially greater than that of cereals and garden vegetables."

In the following tables, by the same authority, the foods are grouped so that those of approximately like nutritive ratios are compared against each other.

Table giving Composition of Foods, showing Waste Matter and Digestible Nutrients.[1]

Kind of Food.	Nutritive Ratio.	Refuse (Per Cent).	Water (Per Cent).	Digestible Dry Matter (Per Cent).
Fat porter house steak,	1 : 2.1	12.7	52.4	38.5
Round steak,	1 : 1.5	7.2	60.7	31.4
Hamburg steak,[2]	1 : 1.5	–	66.0	34.0
Eggs,	1 : 1.7	11.2	65.5	22.2
Skim milk,	1 : 1.8	–	90.5	9.2
Whole milk,	1 : 4.3	–	87.0	12.5
Smoked ham,	1 : 4.2	10.7	48.0	38.3
Cream,	1 : 18.2	–	74.0	25.0
Bacon,	1 : 15.1	7.7	17.4	71.0

[1] Adapted from Farmer's Bulletin 142, United States Department of Agriculture.
[2] Average of 12 fair samples collected in Burlington, Vt.

Table showing Cost of Digestible Nutrients per Pound in Various Foodstuffs.

Kind of Food.	Nutritive Ratio.	Ordinary Price.	Cost per Pound of Digestible Dry Matter.
Porter house steak,	1 : 2.1	30 cents pound.	$0.80
Round steak,	1 : 1.5	20 cents pound.	.64
Hamburg steak,	1 : 1.5	20 cents pound.	.60
Eggs (1 dozen=1½ pounds),	1 : 1.7	36 cents pound.	1.03
Skim milk,	1 : 1.8	2½ cents quart.	.14
Plain milk,	1 : 4.3	7 cents quart.	.28
Ham,	1 : 4.2	25 cents pound.	.65
Certified milk,	1 : 4.3	15 cents quart.	.60
Clean milk,	1 : 4.3	12 cents quart.	.48
Cream,	1 : 18.0	40 cents quart.	.80
Bacon,	1 : 15.0	25 cents pound.	.35

The following rules for the care of milk in the home should be posted in the pantry. They are furnished in card form, free, by the Massachusetts State Board of Agriculture.

1. Take in milk and cream as soon as possible after being left at your door and place in refrigerator.

2. Keep milk and cream cold until ready for use.

3. If ice cannot be had, wrap the bottle in a wet cloth and stand it in an open dish of water by an open window, out of the sun. Evaporation of the water will cool the milk.

4. Keep milk and cream covered until wanted, and in the bottle in which it is delivered. In open bowls or pitchers it will absorb odors from food and collect flies and dust.

5. Pour from the bottle only what milk or cream is needed for immediate use.

6. Milk or cream that has become warm should never be poured back into the bottle of cold milk or cream.

7. Utensils used for milk should first be rinsed with cold water, then washed with warm water and soap or washing powder, and finally rinsed with boiling water, thoroughly drained and allowed to become cold before being filled with milk.

8. Have a separate bottle of milk for the baby.

9. Wash and return all milk and cream bottles daily.

10. No person ailing or sick with contagious disease, or one having the care of such person, should have anything to do with the care of milk or of milk utensils.

Circular No. 2

MASSACHUSETTS STATE BOARD OF AGRICULTURE.

INSECTICIDES, FUNGICIDES,

AND

DIRECTIONS FOR THEIR USE.

By H. T. Fernald, Ph.D.,
State Nursery Inspector.

BOSTON:
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INSECTICIDES, FUNGICIDES, AND DIRECTIONS FOR THEIR USE.

Plants in a vigorous and healthy condition can much better resist the attacks of insects and diseases than when not thriving. Good cultivation, proper fertilizers, the best condition of the soil and careful attention are all, therefore, important factors in the production of good crops. Spraying or other methods of treatment are also frequently needed, however, if the best results are to be obtained, and directions for the preparation and application of spray materials are therefore given here.

Spraying Apparatus.

Most of the pumps now on the market should do reasonably good work when properly used. The nozzle to use for fungous diseases should be some form of Bordeaux nozzle; for insects, in most cases some type of Vermorel nozzle, which sends out the spray as a fine mist or fog, is the best. Hose generally lasts but one season, and is so liable to give out during the spraying the following year that it is better to buy a cheaper grade and expect it to last only during one year. Wash out pumps, hose, nozzle and tank thoroughly as soon as through spraying each time, and drain the hose. Overhaul the apparatus and see that it is in working order before the time comes for its use, or time will be lost when it can least be spared.

The best all-round pump for the average place is a barrel pump, and in most cases one entering the side of the barrel, though this is not essential. On large estates, or with large numbers of trees to spray a power outfit is often more economical in the end. Two, 30 or 40 foot leads of hose, one-fourth or at least not over one-half inch inside diameter, and two extension rods having a cut-off at the bottom, are well worth having.

General Suggestions.

Spray at the right time. Too many people delay spraying until too late to accomplish much good.

Be prepared for breakdowns of pump, hose or nozzle, and have repair parts at hand, particularly extra couplings and hose splicers for burst hose.

Have your materials for making the spray all together and near a water supply. Much time is lost in mixing materials where this is not the case.

Use the right treatment and apply it thoroughly if you desire good results. Remember, however, to stop spraying before the spray runs off. It is only what stays on the tree which does the work, and too much put on will wash off some which would otherwise remain.

"Kill two birds with one stone" whenever possible. Some sprays consisting of a combined insecticide and fungicide, applied at the right time, will kill several different kinds of insects which may be present, and also prevent several of the fungous diseases.

INSECTICIDES.

Insects either chew and swallow solid food or suck the sap from plants. For the former class, poison is usually spread over their food (generally leaves), to be swallowed with it, and such poisons are termed stomach poisons. For the other class, stomach poisons are useless, and materials must be used which kill the insects by touching them. Such materials are called contact insecticides. They are not necessarily poisons in the usual sense of the word.

Stomach Poisons (for Chewing Insects).

1. *Paris Green (Dry).*

Paris green, 1 pound.
Flour or plaster, 100 pounds.

Mix thoroughly and apply evenly; best when dew is on the plants. The use of Paris green in this form is quite limited, spraying it being preferable in most cases.

2. *Paris Green (Wet).*

	Parts.	Per Barrel.
Paris green, ...	1 pound	$\frac{1}{3}$ pound.
Quick lime, ...	2 pounds.	$\frac{2}{3}$ pound.
Water, ...	150 gallons.	50 gallons.

Slake the lime, sprinkling in the Paris green gradually, then add the rest of the water. Do not let it stand long before using. For the peach and other plants with tender leaves use 2½ ounces Paris green and 5 ounces of quick lime to 50 gallons of water, instead of the amounts given above. Keep the mixture well stirred while spraying.

Paris green is coming into disfavor, being much more likely to burn the leaves than arsenate of lead.

3. *Arsenate of Lead.*

Arsenate of lead can be made by the user, but with many good brands on the market, and difficulty in getting the materials from which to make it, it is usually better to buy it. It can be obtained either as a paste or dry, but as a general rule the paste seems to have thus far given slightly better satisfaction. It must be thoroughly mixed with the amount of water called for by the directions sent with it, but can be used stronger if necessary. In general, 3 pounds to 50 gallons of water is the best strength.

Contact Insecticides (for Sucking Insects — Plant Lice, Scales, etc.).

4. *Kerosene Emulsion.*

Any good hard soap, shaved fine, ½ pound.
Soft water, 1 gallon.
Kerosene, 2 gallons.

Dissolve the soap in the water, which should be hot; then remove from the fire, add the kerosene and churn with a hand spray pump, turning the nozzle into the container, continuing the churning until the material gets thick and goes hard through the pump. This is the stock material. For use against plant lice, mix 1 part of this stock with 9 parts of water, and spray.

For tougher insects, such as leaf hoppers, mix 1 part of stock with 5 parts of water.

This is the best contact insecticide for soft-bodied insects, but if for any reason it cannot be used, try

5. *Whale Oil Soap (for Summer Use).*

	Parts.	Per Barrel.
Potash whale oil soap, . .	1 pound.	9 pounds.
Hot water, ...	5 gallons.	45 gallons.

6. *Whale Oil Soap (for Winter Use).*

	Parts.	Per Barrel.
Potash whale oil soap, . .	2 pounds.	80 pounds.
Hot water, ...	1 gallon.	40 gallons.

This was formerly much used as a winter treatment for the San José scale, but is not now considered as good as some other materials. It is included here only in case other treatments cannot be used.

7. *Lime-Sulfur Wash (for Winter Use).*

Fresh stone lime, 20 pounds.
Flowers of sulphur, 18 pounds.
Water, 45 to 50 gallons.

Slake the lime with some of the water in a large iron kettle, sprinkling in the sulfur gradually. Start a fire under the kettle to continue the heat begun by the slaking lime, and boil till the mixture becomes dark orange in color, adding water till 35 or 40 gallons are in the kettle. Boiling should probably take from forty minutes to an hour. Stir frequently, and a successfully prepared lot should have little sediment on the bottom when the boiling is finished. Strain through a fine meshed strainer into the spray pump, adding the rest of the water, and spray while warm. It is generally better to use only the freshly prepared wash, though good results have sometimes been obtained with it even when it has stood over night. This should not be applied to trees after the leaves have opened.

Ready-made lime-sulfur wash is now on the market, and as it is nearly as good as the home-made article, it is generally better to buy it than make it.

8. *Lime-Sulfur Wash (for Summer Use).*

Fresh stone lime, 8 pounds.
Flowers of sulphur, 8 pounds.
Water, 50 gallons.

Place the lime in a barrel and add enough water to almost cover it. When it begins to slake sprinkle in the sulfur through a sieve, to break up any lumps present. Stir constantly and add water as needed to form a thick paste, and then gradually thin to a thin paste. The mixture should boil for several minutes. When well slaked add enough water to cool it; strain into the pump, add the rest of the water and spray. Do not let the mixture remain hot for more than five minutes after the boiling stops. The best action of the lime is obtained when larger amounts than those above are used, hence make up three or four times this formula at one time, if that much will be needed. In straining, take out the coarse particles of lime, but work the sulfur through the strainer.

9. *Miscible (Soluble) Oils.*

These oils can be made by the user, but require so much time and trouble to prepare that it is in most cases better to buy them. Several good brands are on the market, but they should generally be used stronger than the directions call for. One part of the oil thoroughly mixed with from 12 to 14 parts of water is about the best strength to use.

10. *Carbolic Acid Emulsion.*

Hard soap, shaved fine, 1 pound.
Water, 1 gallon.
Crude carbolic acid, 1 pint.

Dissolve the soap in boiling water; add the carbolic acid and churn with a spray pump, as described for kerosene emulsion, until the materials are thoroughly mixed and do not separate on standing. Dilute 1 part of this with 30 parts of water for use.

11. *Hellebore.*

Hellebore, 1 ounce.
Water, 1 to 2 gallons.

Steep the hellebore in a pint of water and gradually add the rest of the water. It may also be used dry, dusted on the plants, either pure or mixed with about half its bulk of flour or plaster.

12. *Insect Powder (Pyrethrum. Buhach).*

Mix with half its bulk of flour or plaster, and keep in a tight can twenty-four hours; then dust on the plants.

FUNGICIDES.

13. *Bordeaux Mixture.*

Copper sulfate (blue vitriol), 4 pounds.
Lime (unslaked), 4 pounds.
Water, 25 to 50 gallons.

Dissolve the copper sulfate in some of the water in a wooden or earthen dish. Slake the lime in a wooden pail, using only enough water, added carefully, to slake thoroughly. Now add water and stir, till the lime is about like thick cream. Place the rest of the water not already used in a barrel, and pour these into the water together and stir. Strain through a fine wire mesh before using.

Trouble in obtaining good Bordeaux mixture may be due to poor lime. Select lumps for slaking, and with small amounts use hot water. In slaking, neither allow the lime to dry nor be entirely covered by water. After the final mixing, put a knife blade into the mixture, and if copper is deposited on the blade add a little more lime.

There are five different strengths of Bordeaux mixture, for use under different conditions.

(*a*) Copper sulfate and lime, 4 pounds each; water, 25 gallons.

(*b*) Copper sulfate and lime, 4 pounds each; water, 50 gallons.

(*c*) Copper sulfate, 3 pounds; lime, 6 pounds; water, 50 gallons.

(*d*) Copper sulfate, 2 pounds; lime, 2 pounds; water, 50 gallons.

(*e*) Copper sulfate, 3 pounds; lime, 9 pounds; water, 50 gallons.

The last three are for use on tender leaves, like peach, etc.; (*a*) above is for use before the leaves open; the others for later applications.

14. *Copper Sulfate.*

Copper sulfate, 1 pound.
Water, 25 gallons.

Do not use on trees in leaf.

15. *Potassium Sulfid.*

Potassium sulfid, 3 ounces.
Water, 10 gallons.

For mildew on gooseberry, etc.

16. *Ammoniacal Copper Carbonate.*

Copper carbonate, 5 ounces.
Ammonia (26 degrees Beaumé), 3 pints.
Water, 50 gallons.

Dissolve the carbonate in the ammonia and keep tightly stoppered. To use, add the water. This solution does not keep long after the water has been added.

17. *Formalin.*

Formalin (40 per cent. formaldehyde), 8 ounces.
Water, 15 gallons.

For scab on potatoes. Keep seed potatoes in this for two hours, then dry before planting.

18. *Corrosive Sublimate.*

Corrosive sublimate, 2 ounces.
Water, 15 gallons.

Dissolve the sublimate in 2 gallons of hot water, then add the other 13 gallons and let stand several hours, stirring occasionally. Put seed potatoes in this for an hour and a half, then dry before planting. Use no metal pails or dishes in this work, and clean everything used, thoroughly, as this substance is very poisonous.

INSECTICIDES AND FUNGICIDES COMBINED.

Where these can be used it is advantageous to do so, as two separate sprayings can often be avoided in this way.

19. *Bordeaux Mixture and Paris Green.*

Bordeaux mixture, 50 gallons.
Paris green, 6 ounces.

Mix the Paris green well into the Bordeaux mixture.

20. *Bordeaux Mixture and Arsenate of Lead.*

Thoroughly mix the amount of arsenate of lead called for by the directions elsewhere in this bulletin, with 50 gallons of Bordeaux mixture.

21. *Lime-sulfur and Arsenate of Lead.*

Work up 2 pounds arsenate of lead well with water; then add to 50 gallons lime-sulfur wash (summer strength), mixing thoroughly.

22. *Ivory Soap.*

Ivory soap (large size), 1 bar.
Water, 15 gallons.

Apply warm.

FUMIGANTS.

23. *Sulfur (for Empty Houses).*

Burn about 6 ounces sulfur to each 1,000 cubic feet of space. Keep house tightly closed for at least twelve hours.

24. *Sulfur (for Houses with Growing Plants).*

Paint some of the heat pipes with a mixture of sulfur and oil; or heat a small amount of sulfur in a kettle over a kerosene stove, taking care that it does not catch fire.

25. *Tobacco.*

Various firms sell paper rolls soaked in tobacco extract to burn in houses. Tobacco extracts of various strength can also be obtained, to evaporate over stoves. The stronger extracts are usually quite effective against plant lice if the house is tight.

26. *Carbon Disulfid.*

Use 2 pounds of carbon disulfid to every 1,000 feet of space, pouring it into shallow dishes in the upper part of the place to be fumigated. Close everything tightly and leave for twenty-four hours. Open and air for ten minutes before entering or using anything fumigated. Do not use this treatment in any place near a fire, hot steam pipes or where there is much heat, as the disulfid catches fire easily, even from a lighted cigar.

27. *Hydrocyanic Acid (for Nursery Stock).*

Potassic cyanid (98 or 99 per cent.).
Sulfuric acid (1.83 specific gravity commercial).
Water.

Multiply the number of cubic feet to be fumigated by .2 or .25, giving the number of grams of cyanid needed for the house or box; divide this by 28.35, giving the weight of the cyanid in ounces. Take 1 fluid ounce of acid and three times as many fluid ounces of water as was taken in ounces by weight of the cyanid. Mix the water and acid in an earthen or granite ware jar, then by loose bag and string drop in the cyanid after tightly closing the place to be fumigated. Leave closed forty minutes, then open from the outside and air for at least ten minutes before entering.

28. *Hydrocyanic Acid (for Empty Houses).*

Potassic cyanid (98 or 99 per cent.), 1 ounce per 100 cubic feet.
Sulfuric acid (1.83 specific gravity commercial), 1 fluid ounce per 100 cubic feet.
Water, 3 fluid ounces per 100 cubic feet.

Mix and use as directed under No. 27.

TREATMENT OF PLANTS.

Apple.

Apple Maggot or Railroad Worm.

Keep the apples which drop from the trees from rotting on the ground by gathering and destroying them. Fallen fruit of early varieties should be picked up twice a week; fall varieties, such as the Porter, etc., once a week; and winter varieties, such as the Baldwin, at least once in every two weeks. Pay especial attention in this regard to the early varieties. Begin as soon as the fruit begins to fall, and continue till the middle of October. If this is done thoroughly there should be little trouble from this pest after the second season.

Bud Moth.

Spray with No. 3, 3 pounds in 50 gallons of water, just as the buds begin to open. Repeat just after the blossoms fall.

Canker.

Cut off and burn diseased twigs. Winter spraying with the lime-sulfur wash (No. 7) for San José scale is also effective for canker. Keep fallen fruit picked up.

Canker Worms.

Band the trunks with tree tanglefoot: October 1, for the fall canker worm; on the first warm day in March, for the spring canker worm; or spray as soon as the blossoms fall, with a stomach poison.

Codling Moth (Apple Worm).

Spray with arsenate of lead, 3 pounds in 50 gallons of water, as soon as the blossoms fall; repeat about the 20th to 25th of June.

Crown Gall.

Buy nursery stock free from this disease. Destroy all trees found affected.

Leaf Spots, Scab, Sooty Mold.

Spray with Bordeaux mixture (No. 13*b*).

Oyster-shell Scale (Oyster Back).

Spray thoroughly as soon as the young hatch (about June 1) with kerosene emulsion (No. 4), stock 1 part, water 6 parts, and repeat in ten days. Dead scales which remain all summer after treatment do not indicate failure of the treatment.

Plum Curculio.

The plum curculio feeds on young apple leaves and also punctures the fruit, causing hard spots with woody places inside them. Spray with arsenate of lead 3 pounds, water 50 gallons, after the leaves begin to develop, but before the blossoms open. Repeat after the blossoms fall, as for the codling moth. Repeat three to four weeks later. Bordeaux mixture can advantageously be combined with the arsenate of lead in these treatments (No. 20). Jarring the trees about sunset, beginning ten days after the blossoms fall, makes the insects drop. Spread a white cloth over the ground before jarring the trees, and destroy those insects which fall on it. Repeat this once every week for about three weeks.

Round-headed Borer.

Look for "sawdust" at the base of the trunk in October and trace this to cavities just under the bark above, in which the borers are, where they may be cut out and killed. Put wire mosquito netting around the trunk in form of a cone, the lower end entering the ground and the upper end close around the trunk about 2 feet up, keeping the borers out and also protecting from mice and rabbits in winter.

San José Scale.

Spray thoroughly during the winter or spring, before the buds open, with lime-sulfur wash (No. 7) or a miscible oil (No. 9). Use a nozzle giving a misty spray. If badly infested, spray before January with the lime-sulfur, and just before the buds open with the oil. With one spraying each year it will probably be better to alternate the lime-sulfur and the oil.

Woolly Aphis.

White, woolly places on limbs in fall, also on roots, these last being the most injurious. Remove the soil to the upper roots 2 feet out from the trunk, and pour on kerosene emulsion, stock 1 part, water 2 parts, mixed; then replace the earth.

General Plan of Treatment.

Spray once or twice during the winter, according to conditions present, with lime-sulfur, miscible oil or both, for the San José scale. Spray with arsenate of lead and Bordeaux (using No. 13*a* for the Bordeaux) just before the buds begin to open, for bud moth and curculio. Repeat just after the blossoms fall (using No. 13*b* for the Bordeaux) for these and also for leaf spots, canker worms and the codling moth. Repeat about the 20th of June for the last insect. For other insects, special treatment.

Asparagus.

Asparagus Beetles.

Keep cutting beds closely cut, leaving a few stalks for the insects to lay their eggs on. Destroy these once a week and let others take their place. Spray the fruit stems with arsenate of lead about once a month during the summer. Let fowls run in the beds.

Asparagus Miner.

A maggot boring in and sometimes girdling the stalks near the ground. Keep the bed cut close as late as possible, except for a few trap plants to be destroyed the last of June.

Rust.

Fertilize highly; cultivate well in dry seasons, and in preparing a new bed use considerable stable manure.

Bean.

Anthracnose.

Use clean seed. Spray with Bordeaux (No. 13*a*) when the leaves open, and repeat if needed.

Weevils in Seed.

Place seed on gathering in a tight box and fumigate for twenty-four hours, using a tablespoonful of carbon disulfid to every cubic foot of space in the box. Keep the box away from fire during the treatment. Then store for winter.

Beet.

Flea Beetle.

Spray with arsenate of lead or Bordeaux (No. 13*b*), as needed.

Leaf Spot.

Spray with Bordeaux (No. 13*b*) when four or five leaves have formed, and at intervals of about twelve days thereafter, if necessary.

Cabbage, Cauliflower.

Black Rot.

Treat the seed with formalin 1 pound, water 20 gallons, for fifteen minutes. Do not plant in ground already infected.

Cabbage Worm.

Spray with arsenate of lead 2 pounds in 50 gallons of water, as needed, till the heads begin to form; then dust with hellebore instead.

Clubfoot.

Do not plant on infected land. On infected land apply 50 to 75 bushels of lime per acre.

Cutworms.

If noticed while preparing the ground for planting, cut clover and spray it with Paris green and scatter it over the field. After the plants are up, make a mash of 60 pounds bran or middlings, 1 pound Paris green, water to make a mash, and enough molasses to sweeten well. Put a teaspoonful of this at the base of each plant and keep fowls away. The cutworms will prefer the sweet mash to the plants.

Root Maggot.

Fit a disk of tarred paper on the ground around the stem of each plant when setting. Hellebore dusted on the ground around the stem about once a week is often successful.

CHERRY.

Brown Rot, etc.

See "Peach."

Curculio.

See "Apple."

Plant Lice.

Spray with kerosene emulsion (No. 7), stock 1 part, water 9 parts, when the lice first appear. After the leaves curl it is too late to treat successfully.

Slug.

Spray with a stomach poison (No. 2 or 3) when they first appear.

CORN.

Wireworms.

To protect seed, dip in arsenate of lead paste diluted with water to consistency of thick paint. Dry and plant. Late fall plowing for several years, rotation of crops, and trapping with freshly cut clover sprayed with a stomach poison and placed under boards in the field, all help to control this serious pest.

CURRANT, GOOSEBERRY.

Currant Worm.

Apply a stomach poison — preferably No. 3 — as soon as the leaves develop.

Currant Stem Borer.

Bores along the center of the stem. Cut off and burn infested stems.

Currant Stem Girdler.

Girdles growing shoots which wilt and are very noticeable. Cut off these shoots as soon as seen, at least 3 inches below the girdled place, and burn them.

Leaf Blight.

Spray with Bordeaux mixture (No. 13*a*) before the leaves start. Repeat later if necessary with No. 13*b*.

Mildew.

Spray with potassium sulfid (No. 15) as soon as the mildew appears.

Cucumber, Melon, Squash.

Anthracnose, Alternaria.

There is little in the way of treatment which is effective for these diseases.

Downy Mildew.

Spray with Bordeaux mixture (No. 13*b* or 13*c*) about August 10, and repeat every ten days if the mildew appears.

Striped Cucumber Beetle.

Start plants under netting. Apply arsenate of lead to the plants, and air-slaked lime or wood ashes around the stem freely.

Squash Bug.

Start under netting. Destroy the clusters of red-brown eggs on the underside of the leaves.

Squash-vine Borer.

Plant some summer squashes early as traps. Start the main crop under netting. Cover stems with earth to start roots from the joints if possible. Harrow in the fall and plow deep in the spring.

In General.

Collect and destroy these plants as soon as the crop has been gathered.

GRAPE.

Anthracnose, Black Rot, Mildews.

Spray with Bordeaux mixture (No. 13*b*) as soon as any of these diseases appear.

Flea Beetles.

Attack the buds, and later the leaves. Spray with arsenate of lead 4 pounds, water 50 gallons, and repeat if necessary. No. 19 or 20 may be used to advantage.

Rose Bug.

Hand picking.

In General.

Spray before the buds open with No. 19 or 20. After the leaves have developed spray with No. 13*b*. Repeat this after the fruit has set, or use it with No. 3, if insects are present.

GREENHOUSE PLANTS.

Control diseases by keeping the houses in the best condition. When empty, fumigate with No. 23 or 28.

Burns and Wilts.

To avoid lettuce top burn, low temperatures on cloudy days and at night, — 35 degrees to 45 degrees at night. Cucumber wilt is caused by too little light and air, and too high temperature.

Rusts.

Select healthy stock. Remove rusted parts. Keep water off the leaves, at least in cloudy weather, watering the leaves only on bright mornings, when they will quickly dry.

Mildews and Leaf Spots.

In general, caused by too much moisture and too little light and air. For cucumber anthracnose and rose mildew paint the heat pipes occasionally with sulfur and oil.

Plant Lice.

Spray with No. 22, or use No. 24 or 25.

Red Spider.

Spray frequently with clear water or soap (No. 22). Spray plants not affected by sulfur with flowers of sulfur 1 ounce, water 1 gallon, and soap enough to make the sulfur mix with the water.

Thrips.

Fumigate with strong tobacco extract vaporized. Repeat as needed.

White Fly.

Fumigate with hydrocyanic acid (No. 27), but use only .007 to .01 gram of cyanid per cubic foot, according to how tight the house is, with the corresponding amounts of acid and water. Fumigate for three hours at night and repeat twice at intervals of fourteen days. Use this treatment with some caution.

Eel Worms.

Freeze, sterilize or change the soil.

Onion.

Onion Maggot.

Apply No. 10 as soon as the plants are up, wetting the ground well around them for 2 or 3 inches. Repeat once a week for about three times. No satisfactory treatment for large fields has yet been found.

Smut.

Wet the seed before sowing, with 1 pint of formalin in 30 gallons of water. A drip attachment to the seeder will do this.

Thrips (Blight).

Collect all refuse in the field as soon as the crop is gathered, and burn it. Burn over all grass land and rubbish around onion fields during late fall, as the thrips winter in such places, and burning destroys large numbers of them.

Oats.

Smut.

Soak the seed for ten minutes in formalin 1 pint, water 36 gallons, then spread out to dry for two or three days.

Pea.

Weevil.

See "Bean."

Peach.

Brown Rot, Scab.

The lime-sulfur wash (No. 7) for San José scale is effective for brown rot. If this has not been used, apply No. 16 before the fruit is fully grown, and repeat if necessary. The lime-sulfur wash (No. 8), either alone or with arsenate of lead (No. 21), applied four to five weeks after the blossoms fall, is very useful, followed by the lime-sulfur (No. 8) alone four or five weeks before the fruit ripens.

Peach Leaf Curl, Twig Blight.

Lime-sulfur wash in winter for the San José scale should protect from these diseases. If it has not been applied, use Bordeaux (No. 13*a*) before the buds swell in spring.

Peach Borer.

Cut out borers early in spring. Mound up earth 18 inches around the trunks in June and remove in September. In California hard asphaltum, grades C and D, heated and applied with a brush to the trunk from below ground to 5 inches above ground, giving two coats, the second as soon as the first hardens, has given good results. How this will work in the east is not yet known.

Peach Yellows and Rosette.

Destroy diseased trees.

Plant Lice.

See "Cherry."

Plum Curculio.

See "Apple."

San José Scale.

See "Apple."

Shot-hole Fungus.

Spray with lime-sulfur wash, as for San José scale. After the leaves develop use Bordeaux mixture (No. 13*d* or 13*e*).

Pear.

Blight.

Remove affected branches. Spray before the leaves develop with No. 7, 13*a* or 14.

Codling Moth.

See "Apple."

Leaf Blights, Fruit Spots.

Spray with Bordeaux mixture (No. 13*b* or 13*c*) as often as necessary.

Pear Psylla.

Spray with lime-sulfur as for San José scale. Spray the ground beneath the tree also. Use kerosene emulsion (No. 4), stock 1 part, water 4 parts, as soon as the blossoms fall.

Pear Slug.

See "Cherry."

San José Scale.

See "Apple."

In General.

Spray just before the buds open with No. 7 for scale, psylla and blight. Just after the blossoms fall spray with arsenate of lead and Bordeaux (No. 20, using 13*b* or 13*c* for the Bordeaux) for leaf feeders, codling moth, blights and spots. Repeat about the 20th to 25th of June.

Plum.

Black Knot.

Cut off and burn infested branches 6 inches below the knots. Spray in early spring with No. 7 or 14.

Brown Rot, Leaf Curl, Shot-hole Fungus.

See "Peach."

Curculio, Peach Borer, San José Scale.

See "Apple" and "Peach."

Potato.

Early and Late Blight, Potato Beetle, Flea Beetle.

Spray with No. 19 or 20 (Bordeaux 13*b*) when the plants are 5 or 6 inches tall, — earlier if the potato beetle is present, — and repeat every two weeks or as often as necessary.

Scab.

Soak seed potatoes one and one-half hours in No. 18 or two hours in No. 17; then dry before planting. Avoid stable manure for fertilizer, using acid phosphate or sulfate of ammonia.

Raspberry, Blackberry.

Anthracnose.

Cut out infested canes.

Rust.

Destroy badly infected plants.

Tree Cricket.

Rows of punctures along the canes in fall, causing them to crack open and die from this point to the tips. Cut off and burn before May.

Rose.

Leaf Hopper.

Spray thoroughly with kerosene emulsion (No. 4), stock 1 part, water 4 or 5 parts.

Plant Lice.

Spray as for hopper, with stock 1 part, water 9 parts.

Red Spider.

Spray with flowers of sulfur 1 pound, water 5 gallons. Add some soap to make the sulfur mix with the water.

Shade Trees.

Elm-leaf Beetle.

Spray about the middle of June with arsenate of lead 5 pounds, water 50 gallons.

Caterpillars, etc.

Spray when these first appear with No. 3, 5 pounds to 50 gallons of water.

Gypsy and Brown-tail Moths.

For information as to the control of these insects, apply to the State Forester, 6 Beacon Street, Boston.

Spruce Gall Louse.

Pick off the soft green galls when they form in May and June: or spray the tree thoroughly with strong kerosene emulsion (No. 4), stock 1 part, water 5 parts, the last of April.

Plant Lice, Woolly or Otherwise.

Spray with No. 4, stock 1 part, water 9 parts, when they appear.

Strawberry.

Crown Borer.

Eats out the crowns of the plants. Start new beds some distance away, using only young runners. Move the beds every two or three years.

White Grubs.

Rotation of crops, leaving the beds in the same places as short a time as possible.

Tomatoes.

Cutworms.

See "Cabbage."

Flea Beetle.

See "Potato."

Circular No. 3

(Supplanting Nature Leaflet No. 42.)

MASSACHUSETTS STATE BOARD OF AGRICULTURE.

BALANCED RATIONS

FOR

DAIRY STOCK.

By J. B. Lindsey, Ph.D.,
Chemist to the Board.

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BALANCED RATIONS FOR DAIRY STOCK.

BY J. B. LINDSEY.

1. Composition of Cattle Feeds.

All cattle feeds, whether in the form of grains and their by-products, or as hay, corn silage and straw, are composed of the following groups of substances: —

Water. — The several grains and their by-products contain from 7 to 12 per cent of water; hay and straw, 12 to 16 per cent; field-cured corn stover, 30 to 40 per cent; and corn silage, 76 to 80 per cent.

Ash represents the mineral ingredients, and constitutes the ashes after the feed is burned. These ashes consist of lime, potash, soda, magnesia, iron, phosphoric and sulfuric acids.

Protein is a collective name for all of the nitrogenous matter; it corresponds to the lean meat in the animal, and may be termed "vegetable meat." It has the same elementary composition as animal flesh. When fed to animals as a component of the various feed stuffs, it serves as the exclusive source of flesh as well as a source of heat or energy and fat.

Crude fiber or cellulose is the coarse or woody part of the plant. It may be called the plant's framework. It is a source of heat or energy and fat.

Non-nitrogenous extract matter represents the sugars, starch and gums. It is the principal source of heat or energy and fat for the dairy animal.

Fat includes not only the various oils and fats in all grains and coarse fodders, but also waxes, resins and coloring matters. It is frequently termed *ether extract,* because it is that portion of the plant soluble in ether. It serves as a source of heat or energy and fat in the body of the animal.

Carbohydrates is a term which is generally used to include both the fiber and the extract matter.

It will thus be seen that all of the several groups of nutrients — protein, carbohydrates and fat — are sources of energy; that is, they furnish the food or fuel to maintain the life of the body. They also are convertible into fat. The protein, however (including the ash), is the only source of flesh or lean meat. In order to form the bones all of the groups are used.

2. Digestibility of Cattle Feeds.

The several groups of nutrients above described, which make up the various cattle feeds, are valuable to the animal only in so far as they can be digested and assimilated. The concentrated feeds are considerably more digestible than the coarse fodders, as a single illustration will show: —

	100 Pounds Timothy Hay.			100 Pounds Gluten Feed.		
	Composition.	Per Cent Digestible.	Pounds Digestible.	Composition.	Per Cent Digestible.	Pounds Digestible.
Water,	15.0	-	-	8.5	-	-
Ash,	4.3	-	-	1.7	-	-
Protein,	6.3	48	3.0	26.2	85	22.3
Fiber,	28.4	58	16.5	7.2	76	5.5
Extract matter,	43.6	63	27.5	53.3	89	47.4
Fat,	2.4	61	1.5	3.1	83	2.6
Totals,	100.0	-	48.5	100.0	-	77.8

In the first and fourth columns are given the composition of average samples of timothy hay and of gluten feed. In the second and fifth columns are shown the percentages of the different groups which are digestible. Thus, of the 6.3 pounds of protein in timothy, 48 per cent are digestible, or 3 pounds; and of the 26.2 pounds of protein in 100 pounds of gluten feed, 85 per cent, or 22.3 pounds, are digestible. Excluding the ash, which is not generally taken into account, it is shown that 100 pounds of timothy hay contain about 48 pounds of digestible or actual food material, and 100 pounds of gluten feed 78 pounds. It is evident, therefore, that the gluten feed is decidedly more valuable as a source of nutrition than the timothy hay.

3. Method of Measuring the Efficiency of Feeding Stuffs.

The digestibility of a feed, however, is not the true measurement of its nutritive value, for the reason that some feeds require more energy for their digestion than others. What is termed *net energy value,* expressed in the form of calories or therms, represents more accurately the true nutritive values of feeding stuffs.

Explanation. — The entire amount of heat or energy contained in a feeding stuff is termed its *total heat* or *energy* value. All of this heat or energy cannot be utilized by the animal for the purposes of maintaining its body in a state of equilibrium, or for aiding in the production of growth and milk. The several losses may be enumerated as follows: (*a*) the undigested material, *i.e.*, the fæces; (*b*) the incompletely used material of the urine; (*c*) the work required in the processes of digestion and assimilation in preparing the nutrients so that they can be used for maintenance and for the production of growth and milk. These several sources of loss expressed as energy, deducted from the total energy, leave the real or *net energy value.*

Here follows a table showing the *relative* net energy values of a few of the more important feeding stuffs. Instead of expressing the relative energy values in therms of energy, they are stated on the basis of 100 for the sake of direct comparison. The figures were secured by the use of the so-called Kellner method.[1] They are not perfect, but represent the results of the best method that we have available at this time. Corn meal is taken as 100 and the other feeds, both concentrated and coarse, are compared with it: —

Corn meal,	100.00
Apple pomace,	10.99
Brewers' dried grains,	65.96
Brewers' wet grains,	17.78
Buckwheat middlings,	89.82
Corn bran,	77.78
Corn silage,	12.40

[1] For a full explanation of the components of the animal body, the composition of feeds, the different ways in which the food is used in the animal body, and the explanation for using the therm in the calculation of rations for farm animals, see Farmers' Bulletin 346, United States Department of Agriculture, prepared by H. P. Armsby.

Corn stover, from field,	27.37
Corn stover, very dry,	36.26
Cottonseed meal,	94.50
Distillers' dried grains, largely from corn,	93.80
Gluten feed,	90.99
Hay, barnyard millet,	35.91
Hay, English (mixed grasses), fine early cut,	43.16
Hay, Kentucky blue grass,	40.94
Hay, orchard grass,	37.54
Hay, red top,	42.81
Hay, rowen,	48.07
Hay, swamp or swale,	22.92
Hay, tall oat grass,	36.02
Hay, timothy,	36.02
Hominy meal,	104.80
Linseed meal (old process),	93.92
Malt sprouts,	65.96
Oats, ground,	83.27
Wheat bran,	57.31
Wheat kernels, red,	92.28
Wheat kernels, white,	93.92
Wheat middlings (flour),	98.01
Wheat middlings (standard),	67.37

It should be borne in mind that the above figures express only net energy and not protein value. If protein is needed to balance the ration, it can be purchased most economically in the high-grade protein concentrates, such as cottonseed meal, gluten meal, gluten feed, distillers' dried grains and the like.

4. Nutritive Ratio of Cattle Feeds.

The numerical relation which the digestible protein bears to the other digestible organic nutrients (fiber, extract matter and fat[1]) is termed the nutritive ratio of the feed or ration. Timothy hay has, for example, 3 parts of digestible protein to 47.3 parts of other nutrients, or as 1 is to 15.8. This is termed a very wide nutritive ratio. Gluten feed contains 22.3 parts of digestible protein to 58.6 parts of other nutrients or as 1 is to 2.6. This may be termed a very narrow nutritive ratio or proportion. All feeds having a nutritive ratio of 1 to 5 or less may be said to have narrow ratios, those from 1 to 5 to 1 to 8 a medium ratio, and above 1 to 8 a wide ratio.

[1] The fat is converted into the energy equivalent of the starch or fiber by multiplying by 2.2; thus, 3 per cent of fat would have an energy equivalent of 6.6 per cent or parts of starch.

The cereals and non-leguminous coarse fodders have medium to wide ratios, leguminous coarse fodders medium ratios, and the leguminous seeds and concentrated by-products narrow ratios.

5. Combining Coarse and Concentrated Feeds (Balanced Rations).

Desirable rations for dairy stock should possess (*a*) palatability, (*b*) sufficient bulk, and (*c*) 1 part of protein to 5.5 to 7 parts of the other digestible organic nutrients. If the ratio is much narrower than 1 to 5.5, the ration is likely to be too stimulating for continuous feeding, and the animal is likely to become thin in flesh. If the ratio is much wider than 1 to 7, the tendency will be for the animal to put on fat rather than to give milk. In both cases the ration may be said to be *out of balance.*

For both economical and physiological reasons it is necessary that a considerable portion of the daily ration of the dairy animal should be composed of coarse fodder or roughage, because such materials are easily and cheaply produced upon the farm, and because the digestive tract of the bovine is especially suited to utilize them. Most of these home-grown coarse feeds, however, are very high in carbohydrates and have a relatively low digestibility. It is necessary, therefore, to supplement them to an extent with the cereal grains, which, though relatively low in protein, are very digestible; and with the concentrated by-products, which, in addition to a relatively high digestibility, are quite rich in protein. A single illustration will make this clear. Many experiments have demonstrated that a 1,000-pound cow, producing daily 10 quarts of milk of average quality, needs approximately the following amounts of *digestible* nutrients: —

Digestible.	Protein.	Fat.	Carbohydrates.	Total.	Nutritive Ratio.
Pounds, . . .	2.25	.5	13 or 13.5	16	1 to 5.6 or 7

Now, if this animal were fed daily as much of an *extra* quality of hay as she would consume (28 to 30 pounds), she would receive: —

Digestible.	Protein.	Fat.	Carbohydrates.	Total.	Nutritive Ratio.
Pounds, . . .	1.3	.3	13	14.6	1 to 10.5

Such a ration is deficient in total digestible nutrients as well as in digestible protein. If 7 pounds of the hay were replaced by an equal amount of corn meal, the hay and corn meal would furnish: —

Digestible.	Protein.	Fat.	Carbohydrates.	Total.	Nutritive Ratio.
Pounds, ...	1.4	.47	14.35	16.22	1 to 11

The corn meal being very digestible, but a one-sided or starchy feed, would sufficiently increase the total digestible nutrients, but not the protein. If 4 pounds of corn meal were replaced by 2 pounds of bran and 2 pounds of cottonseed meal, the several feeds would supply: —

Digestible.	Protein.	Fat.	Carbohydrates.	Total.	Nutritive Ratio.
Pounds, ...	2.07	.60	13.20	15.87	1 to 6.6

The replacing of 7 pounds of hay with 3 pounds of corn meal rich in digestible matter and with 2 pounds each of bran and cottonseed meal especially rich in digestible protein, furnishes a ration containing less fiber and more starchy matter and protein than is contained in the hay. Such a ration contains the requisite amount of both total digestible matter and digestible protein, and may be said to be *properly balanced.*

6. Types of Balanced Rations.

Because of the high prices usually prevailing for all concentrated feeds, dairymen are frequently in doubt as to the kinds to be selected and the amount to be fed in order to secure the best returns for the money invested. Farmers selling cream to the creamery, or located where there is not a quick demand for milk, probably will not find it economical to feed over 3 to 5 pounds of purchased grain daily, and will use maximum amounts of home-grown hay and silage (1 to 1½ bushels of silage and what hay the animal will eat clean). If the silage is well eared, 1½ pounds each of cottonseed meal and flour middlings, sprinkled over the silage to distribute it, will produce a fairly well-balanced ration, and prove helpful in maintaining the milk flow. If corn meal is a home product rather than silage, mix by weight ¼ bran, ½ corn and cob meal and ¼ cottonseed meal (100 pounds bran, 200 pounds corn and cob meal and 100 pounds cottonseed meal), and feed 5 to 6 quarts daily, or by weight, $\frac{2}{3}$ corn and cob meal and $\frac{1}{3}$ cottonseed meal and feed 4 to 5 quarts daily, together with one feeding of cut or shredded corn stover and what hay the animal will clean up.

Producers of market milk generally find it advisable to feed somewhat more grain, and a number of combinations are suggested which will produce satisfactory balanced rations when fed with what hay the animal will eat clean (18 to 24 pounds a day), or with 1 bushel of corn silage and 10 to 16 pounds of hay.

I.

100 pounds bran.
100 pounds flour middlings.
100 pounds gluten feed.
Mix and feed 6 to 8 pounds (7 to 9 quarts) daily.

II.

100 pounds bran.
100 pounds corn or hominy meal.[1]
100 pounds cottonseed meal.
Mix and feed 6 to 8 pounds (7 to 9 quarts) daily.

III.

100 pounds wheat bran.
200 pounds gluten feed.
35 pounds cottonseed meal.
Mix and feed 7 pounds (7 quarts) daily.

IV.

100 pounds wheat bran or malt sprouts.
100 pounds corn or hominy meal.
150 pounds gluten feed.
Mix and feed 7 pounds (or quarts) daily.

V.

75 pounds wheat bran.
150 pounds corn and cob meal.
100 pounds cottonseed meal.
Mix and feed 6 to 7 pounds (or quarts) daily.

VI.

100 pounds distillers' grains.
100 pounds malt sprouts.
150 pounds corn meal.
50 pounds cottonseed meal.
Mix and feed 7 pounds (7 to 8 quarts) daily.

VII.

150 pounds distillers' grains.
150 pounds standard middlings.
100 pounds corn or hominy meal.
Mix and feed 7 pounds (or quarts) daily.

VIII.

150 pounds wheat bran.
200 pounds gluten feed.
Mix and feed 7 pounds (8 to 9 quarts) daily.

IX.

200 pounds dried brewers' grains.
100 pounds corn meal.
50 pounds cottonseed meal.
Mix and feed 7 pounds (9 quarts) daily.

X.[2]

300 pounds bran.
100 pounds flour middlings.
100 pounds corn meal.
100 pounds ground oats.
300 pounds gluten feed.
100 pounds linseed meal.
Mix and feed as desired.

XI.

1.5 pounds gluten feed.
1.5 pounds cottonseed meal.
4.0 pounds dried beet pulp.[3]

XII.

3 pounds distillers' grains.
4 pounds dried beet pulp.[3]

---

[1] Corn and cob meal if on hand can be used in place of corn or hominy meal.
[2] Ration designed for cows on test; rather expensive for ordinary purposes.
[3] Beet pulp should be moistened with two to three times its weight of water before feeding.

The cost of a pound of the several mixtures is likely to vary from 1.4 to 1.6 cents. It is believed that the above selections are more economical on the basis of their content of nutritive material than most of the sugar feeds and other proprietary mixtures.

In general it may be said that the *amount of grain* to be fed daily depends (*a*) upon the size of the cow, (*b*) daily milk yield and (*c*) the local market value of the milk. The richer the milk, the more food is required to produce a given amount; and *vice versa*.

Six to 7 pounds of the above mixtures is a fair average amount for cows weighing 800 to 900 pounds, which are yielding 10 quarts of 4 to 5 per cent milk. For every 2 quarts of milk yielded in excess of this amount the grain ration may be increased by 1 pound.

7. Rations for Young Stock.

Young dairy stock may receive 1 peck or more of silage daily, depending upon their size, in addition to what hay, corn stover or other coarse fodder they will eat clean; or the entire roughage may consist of hay. Ten to 15 pounds of roots daily in cases where silage is not available will prove appetizing and helpful. Grass and clover rowen form a very desirable feed for growing animals. In addition to the above, it is usually advisable to feed from 1 to 3 pounds daily of a grain mixture reasonably rich in protein and ash.[1] Any of the above mixtures will prove satisfactory. The writer has found mixtures by weight of $\frac{1}{2}$ wheat bran and $\frac{1}{2}$ flour middlings; or $\frac{1}{2}$ bran, $\frac{1}{4}$ corn meal and $\frac{1}{4}$ flour middlings; or $\frac{1}{2}$ bran, $\frac{1}{4}$ corn meal and $\frac{1}{4}$ ground oats quite satisfactory. A ration composed of late-cut hay and corn meal would not be desirable, it lacking both flesh and bone forming material (protein and ash).

Several months before the heifer freshens it is well, if circumstances permit, to increase the grain ration to 5 or 6 pounds per day in order to get her used to grain and to encourage a large future milk flow.

The feeder will do well to bear the following in mind: —

1. Late-cut hay is noticeably less nutritious than early-cut.

---

[1] If the roughage consists largely of grass or clover rowen, 2 pounds daily of a mixture of bran and corn meal, or even of corn meal alone, will prove satisfactory.

2. The fine grasses are more nutritious than the coarse.

3. The clovers and alfalfa should be cut in early bloom. If cut in late bloom their nutritive value is noticeably lessened.

4. Concentrated feeds, aside from their palatability, should be purchased for their high digestibility or net energy value and protein content.

5. The cereals have a high net energy value; cottonseed meal, gluten feed, distillers' dried grains and flour middlings, while they are highly digestible, are purchased as a rule because of their protein content.

6. Wheat bran is an expensive source of nutrition, but its bulk and laxative qualities frequently commend its use to eastern feeders in amounts not exceeding 25 to 30 per cent of the entire grain ration.

7. Some proprietary grain mixtures are fairly economical; others which contain low-grade by-products are quite expensive, due to the fact that such feed mixtures are sold at about the same prices as the high-grade concentrates.

8. The farm is the carbohydrate factory. As a rule, it is not practicable for the farmer or dairyman to produce all of the high-grade protein feeds to supplement his home-grown carbohydrates.

He should endeavor to produce as much as possible of the needed protein in the form of clover, alfalfa or soy beans. In some cases he will find it necessary to purchase corn and the like, but this is as a rule not good economy.

The Commonwealth of Massachusetts.

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Apple Packing for Massachusetts Growers.

By ALBERT R. JENKS, formerly with the Turner Hill Farm, Ipswich, Mass., now Horticultural Adviser, Hampden County Improvement League, Springfield, Mass.

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MASSACHUSETTS
STATE BOARD of AGRICULTURE
APPLE EXHIBIT
THIS EXHIBIT
SHOWS SOME of THE DIFFERENT WAYS
OF PACKING GOOD APPLES in BOXES.
SPRAY
YOUR FRUIT TREES
FEEL FREE
TO ASK QUESTIONS
CULTIVATE
PRUNE
NAIL YOUR BOX
UP THIS WAY

APPLE PACKING FOR MASSACHUSETTS GROWERS.

By ALBERT R. JENKS.

The fast-growing commercial importance of the apple crop in Massachusetts demands that the packing phase of the industry be given intelligent study, and that all discoveries of proven worth be put into practical application. As the apple crop increases in size the cheaper grades will be pushed from the market. The selling price of the better grades will be lowered, thus making it possible for more people to use a large quantity of apples each succeeding year. Along with a lower selling price, the cost of production must be reduced and better methods of packing adopted.

Wonderful strides have recently been made in the methods used by fruit growers in the management of their orchards. Only very recently have growers begun to give more time and attention to the packing and marketing of their fruit. At present this is fully one-half of the problem. It is true that we have improved upon our forefather's method of harvesting his fruit, — that of shaking the apples to the ground and picking them up in sacks, or allowing them to fall off and then picking them up. It has remained for our western pioneer apple growers to teach us really up-to-date methods. Improved methods of picking must precede any advance in the packing of apples. Too little thought oftentimes is given to this phase. Apples may be excellently grown and finely packed, but unless they are carefully picked they will not bring the highest market price. It is very hard to know just when an apple has reached the stage when, if picked, it will keep the longest and still retain the highest quality for culinary and dessert purposes. The time will vary according to the soil, its moisture content, the variety of apple, the stock, the exposure and the purpose for which the fruit is sold. Experience is necessary to determine this point, but there is less danger of picking too early than too late. A fair test of ripeness is to lift the apple gently and twist it slightly. If it parts readily from the spur, the apple is ripe enough to pick. If the apples are to be placed in ordinary storage they should be picked earlier than if they are to be put into cold storage.

Harvesting.

In picking apples handle them as carefully as eggs. Employ men who can pick with two hands. Great care should be exercised not to detach the stems, because when a stem is pulled out it breaks the skin; this allows the bacteria to enter the apple, resulting in rot and disease in an otherwise sound apple. Many markets refuse apples with 25 per cent. of the stems missing. Equal care should be exercised in picking apples to leave all fruit spurs unbroken upon the limbs. Each broken spur means that several apples are deducted from the next three or four years' crops. This is an absolutely unnecessary loss, if due care is exercised. Men should never be allowed to climb into the trees while picking, especially young trees, because broken branches and bruised limbs are bound to result from such a procedure. Wounds and bruises upon the limbs constitute ideal conditions under which canker diseases start and flourish. Light, strong stepladders should be used for low trees; for taller trees, light pointed ladders, which will fit into crotches in the limbs, are better than straight or round ladders. Extension ladders are necessary for very tall trees.

There are many kinds of picking bags, buckets and baskets upon the market. Most growers prefer the oak, splint, half-bushel basket which has a swinging bale, allowing the basket to be lowered into the barrel or other receptacle and the contents poured out without any danger of bruising the fruit. The baskets should first be oiled, thus making them more

FIG. 1. A picking scene in a Massachusetts apple orchard.

durable; they should then be padded with canvas or burlap. Picking receptacles that open from the bottom are not entirely satisfactory at present, and picking bags tend to bruise the apples more or less. Heavy wire bent in the form of the letter S, with the upper part large enough to put over limbs and the lower part to fit the handle of the basket, are very useful. This will enable the pickers to use both hands. It is quite essential that practically all the picking be done by hand as, up to the present time, the patent pickers have not been so perfected as not to bruise the fruit, or else they are deficient in other ways. Patent pickers may be used for stray scattered apples.

The question of field receptacles for the apples now arises. This all depends upon the future use of the fruit. One must have previously decided whether or not any of the apples are of high enough quality to box. Many Massachusetts growers are adopting some of the good western methods. Box packing, the packing of apples in packages smaller than the apple barrel, generally the bushel box, is one of these good methods. Some Massachusetts growers, however, are adopting box packing long before the quality of their apples justifies this method. This is a serious mistake. The apple box should be used only for apples of extra good quality. The grower can realize the most money from his apples when packed in this way. For instance, it would be difficult to obtain $7.50 to $9 per barrel for good McIntosh apples, but there is an excellent market for A–1 McIntosh apples packed in boxes at from $2.50 to $3 a box. The fruitstand man likes the box package because he knows how many apples he is buying for a certain sum, and therefore knows how many he can sell for 10 cents and still make a good profit. The apples packed in this way must be sound and of a uniform size, color and shape. The consumer likes the box package because it is more attractive, and because he can use them all before they decay; satisfaction being given, additional sales are guaranteed. Quality being secured, it is still hard to say just what varieties should be put into boxes in preference to barrels. We are now testing out markets with box apples, and a few more years' experience will show which varieties may be marketed in this way. At present it looks as if the following varieties, if of high enough quality, should be boxed in order to secure the largest returns: —

Yellow Transparent.	McIntosh Red.
Red Astrachan.	Baldwin.
Duchess.	Sutton Beauty.
Gravenstein.	Alexander.
Wealthy.	Rome Beauty.
Fameuse.	Northern Spy.
Winter Banana.	King.
Wagener.	York Imperial.

Many of these varieties will yield even greater profits if put into smaller packages than the bushel box.

Above all things, do not box apples if they are not of the very best quality. The fact that many growers in Massachusetts have been boxing apples suitable only for sale in barrels has put eastern box apples into disfavor among the commission men. As a rule, it is well to box only a small fraction of a crop from old renovated trees, and grade the remainder for barrels and culls. Hampers, baskets, corrugated packages and other small receptacles have not yet become practical enough to demand the consideration of the average grower. They are suitable for special markets, and each individual must determine their suitability in his own case.

Apples which are to be boxed should be handled with even greater care than fancy barrel apples. The field receptacle should be of small dimensions, preferably something in the nature of a common bushel box. The apples should be laid into the box, not poured in. It is advisable to place a sheet of cheap paper between each tier of apples in the box, thus eliminating all danger of puncture from the stems of other apples. Do not fill the box entirely full, or, if this is done, risers should be used upon the ends of the boxes in order to be able to stack them without danger of bruising the apples. The ideal receptacle will probably be something in the nature of a box 36 by 18 by 11 inches. It is not practicable to box-pack apples in the field. They should be hauled to the packing shed, and immediately graded, packed and marketed, or put into cold storage.

If one plans to pack his apples in barrels it is always a debatable question whether or not the packing should be done in the field or in the packing shed. Local conditions oftentimes decide this question. It is generally better, however, to haul the apples to a central packing place, as the facilities for better and more rapid work can there be provided. Barreled apples thus packed generally bring 10 or 15 cents more a barrel, because, as a rule, the work is done better. Then, too, if the apples are brought immediately to a central packing house, they generally have an opportunity to become cool before they are placed in the barrels. This adds to their keeping qualities very materially. If the varieties are in large, compact blocks in the orchard, and the packing shed is quite a long distance away, it undoubtedly is cheaper to pack the apples in the field. In this case one needs no field receptacles, as the pickers can empty their baskets directly upon the sorting table. When the packing-shed plan is followed, cheap but firm barrels are probably the best field receptacles. These should be filled not more than four-fifths full. A low-down spring wagon, with a broad platform and broad wheels which will turn in under the platform, should be used. Such a wagon is shown in Fig. 1, opposite page 4. Recently, bolster springs have been placed upon the market. By using these springs almost any wagon may be made suitable for orchard use. Fruit hauled on such a wagon will be bruised but very little.

Barrel Packing — Standard Barrel.

Many different types of tables are in use for sorting apples for barrel use. The most common table is shown in Fig. 2. This represents what is called the end-delivery table, and is a very good table for use when one is careful not to handle the apples roughly. The dimensions are as follows: length, 7 feet; width at back, $3\frac{1}{2}$ feet; height at front, 32 inches; height at back, 36 inches; height of side boards, 6 inches.

Spaces are left between the boards in the bottom of the table for the dirt and leaves to sift through. The boards must be of a soft wood and smoothed off, in order not to injure the fruit. The back of the table is purposely made five or six inches higher in order that the apples may roll down towards the front.

It is necessary to have three men working at such a table to get the best results. An upturned barrel is placed at the end of the table. On this is placed a basket for a certain grade, — the grade which is running the smallest. A man stands at the side of the table and sorts. He has one or two upturned barrels beside him which hold the baskets for other grades. The third man in the crew knocks the tail end out of the barrels, picks out the facer apples, puts them into the barrels and empties the baskets of the two sorters into their proper barrels. Three men working in a crew in such a manner will average about 40 to 45 barrels per day. One extra man can head up and stencil all the barrels put up by three such crews.

A heavier table is often used in packing-house work. It is 9 feet long, 6 feet wide and 33 inches high in front, with the table running lengthwise. The back of the table is 38 inches high and the side 8 inches high. The bottom is slatted, as in the end-delivery table. Three men are needed in the sorting crew, as at the other table. The only advantage of this table is the fact that more field barrels can be emptied upon it at one time.

The Sulzer bill, which was signed by the President Aug. 3, 1912, and which became operative July 1, 1913, standardizes the apple barrel and takes care of the grades of the apples. The bill follows: —

THE SULZER BILL.

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

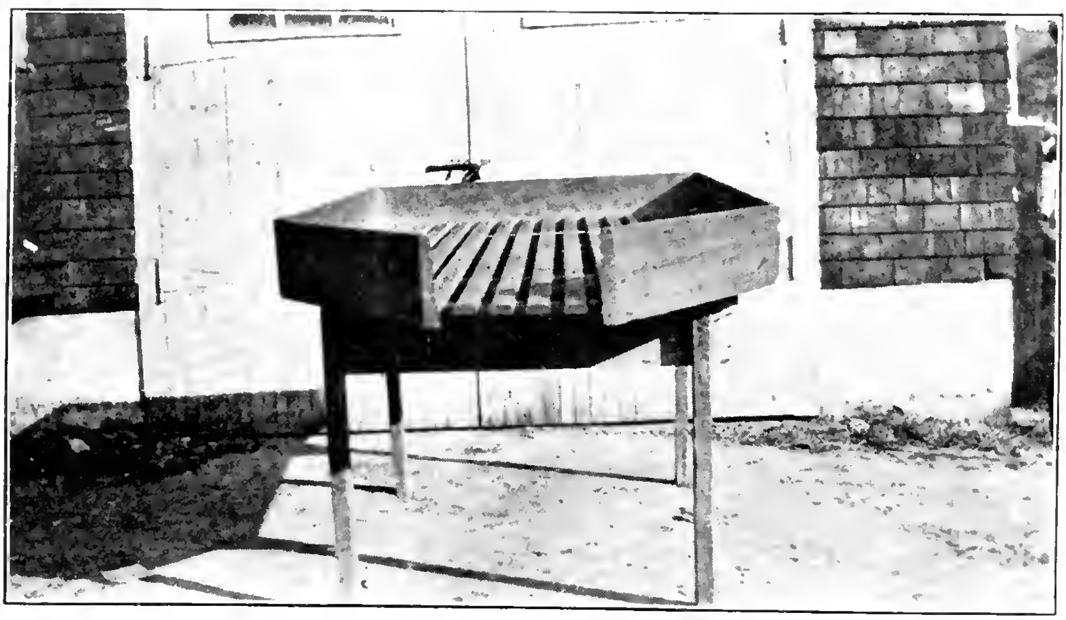

FIG. 2. — End-delivery sorting table.

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.

SEC. 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 percentum 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.*

SEC. 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.

SEC. 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.

SEC. 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.

Sec. 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.

Sec. 7. That this Act shall be in force and effect from and after the first day of July, nineteen hundred and thirteen.

It is seen that there is but one grade and but three sizes, which are governed by the minimum size of the apples in each grade.

Any one desiring a copy of this law, with explanations and advice, may obtain it by writing to the International Apple Shippers' Association, 613 Mercantile Building, Rochester, N. Y. Any one desiring further information should write to the secretary of the State Board of Agriculture, Room 136, State House, Boston, Mass.

Owing to the frequent difficulty of obtaining apple barrels, one should order them in advance of the time they are needed. Use only new barrels for the best size and perhaps for the second best size. If second-hand barrels are used at all they should be carefully cleaned. Hard-wood barrels with elm hoops are the best.

The actual packing of the barrel consists in placing a corrugated head on the bottom of the barrel. The final top of the barrel is the bottom as it is being packed. If the quality of the apples warrants it, a fancy lace paper circle is next put into the barrel. An oiled or paraffined paper circle is put in next, which prevents any dirt which may possibly sift into the barrel through the cover from coming in contact with the fruit, and also prevents excessive moisture transpiration from the apples. The head of the barrel is now faced with uniform sized apples of a grade which is typical of the contents of the barrel. These apples should be of good color, or at least show good color around the stem ends.

Stemmers or small shears should be used to cut the ends from the long stems, so that they will not puncture the oiled paper circle and will rest more evenly upon the face end. This is sometimes omitted in strictly commercial work. The face layer is put in stem end down, in concentric circles. The outside or larger circle is placed first, of a uniform sized apple which will just fill the circle snugly. Each concentric circle is placed in the same way. The center will require one, two, three, four or six apples, varying in accordance with the sizes of apples used. The next layer is placed the same way by some growers, especially for their extra fancy and exhibition barrels. Most commercial growers now make the second layer by placing the heavy colored cheek of the apples in the cavities formed between the apples of the face layer. This method makes the barrel look much better when opened. About a bushel of apples is next carefully emptied upon these two face layers, before the barrel is shaken at all. The barrel should be carefully shaken then, and after each succeeding basket is put in, until it is full. The shaking, or "racking" as it is called, tends to work the apples down into all of the cavities. In this way a compact package is secured and possibility of bruising is eliminated.

The height to which the barrel should be filled varies according to varieties, and opinion on this point differs in different localities. It should be just high enough so that when the head is pressed in all apples will be held firm, and yet not so tight as to bruise them. The last layer should be placed with stem ends uppermost. This makes it easier to put the head in, and if by mistake the bottom should be opened, it will present a much better appearance. A corrugated head is also used at the tail end as it helps to prevent bruising when the tail is pressed in. It should be nailed in place with six three-and-a-half-penny nails. It is advisable also to nail liners to the tail end of the barrel. The barrel is reversed, and if it is to be shipped a long distance the head should also be nailed in a like manner as an added precaution. The head of the barrel should be stenciled in accordance with Section 5 of the Sulzer bill.

Barreled apples if held for any length of time should be placed on their sides. They should be packed in a car in this way. This method of storing prevents the fruit in a barrel from bearing the weight of other barrels, because the package itself bears it.

The following score card, or some slight modification of it, is generally used for judging the barreled apples: —

	Points.
Uniformity of size of apples,	20
Uniformity of color of apples,	20
Uniformity of shape of apples,	10
Condition and freedom from blemishes,	20
Attractiveness, including facing and tailing,	15
The barrel and trimmings,	5
Firmness of apples in the barrel,	10
	100

Box Packing.

The western growers have succeeded wonderfully with the apple box. This is due entirely to the fact that they were compelled to pack quality apples. Furthermore, they cannot afford to ship the cheaper grades of apples the long distance to the markets.

The Box.

The first consideration in box packing is the box itself. Many shapes and sizes have been used. At present, however, there are only two in general use. The dimensions are: Special, 10 by 11 by 20 inches, inside measurement; Standard, 10½ by 11½ by 18 inches, inside measurement.

The boxes contain a trifle less than a standard bushel, but when they have the necessary bulge they accommodate more than a bushel. The two boxes are designed for different sized apples, but the Standard is being used more and more, probably about 70 per cent at the present time. Apples are sold by the number in the box and not by weight or measure.

The ends of the box should be of one piece, ¾ inch thick, with the grain running crosswise; the sides should be ¼ to ⅜ inch thick and of one piece; the tops and bottoms should be of two pieces each, a little less than 1/4 inch thick, the two pieces making them more elastic. There should be two cleats for the top of the box and two for the bottom on each end. These hold the top and bottom securely, as the bulge has a tendency to push the thin boards over the nail-heads. The boxes generally come knocked down, and can be put together during rainy weather, before the season opens. Four nails should be used for the sides, at each end. Four or five penny cement-coated nails are the best; they hold better.

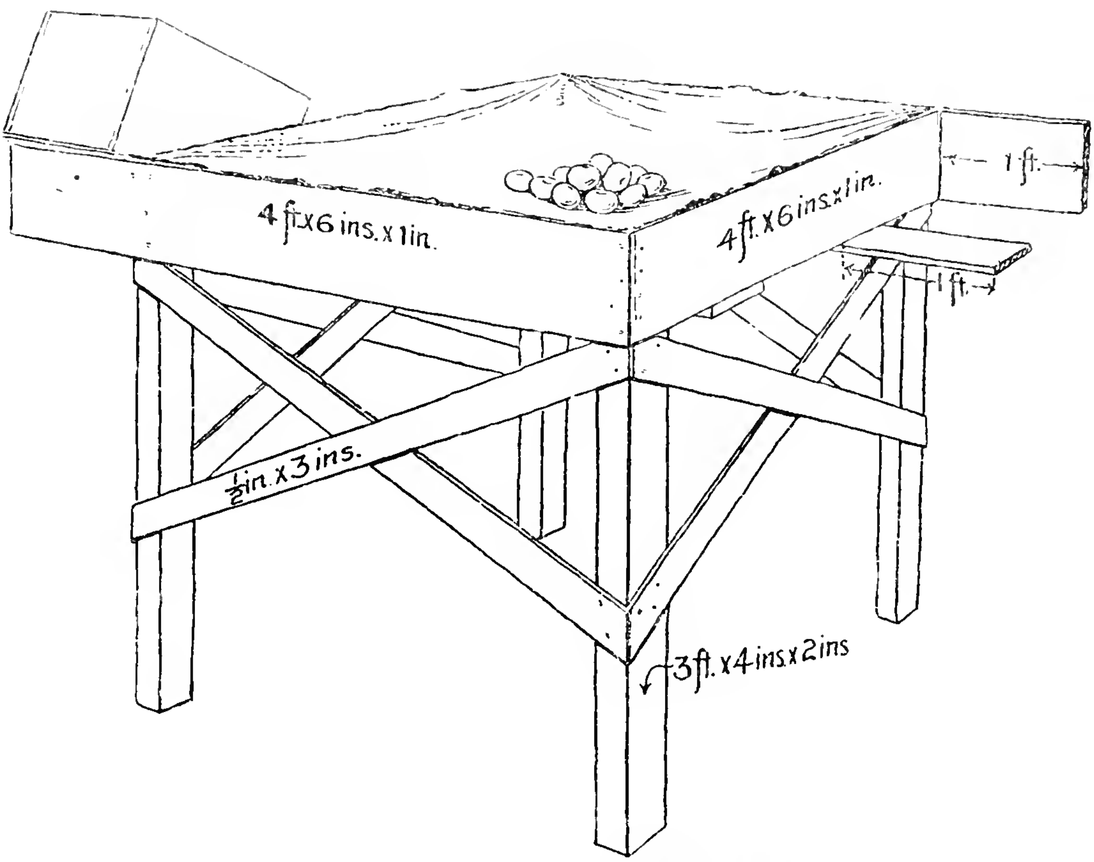

FIG. 3.—A convenient type of packing table.

The Packing Table.

The packing table, such as is shown in Fig. 3, is about 3 by 4 feet, made of 6 by 1 inch boards with 2 by 4 inch joists as posts. A stout canvas is stretched across the top of the boards. An old piece of rubber hose may be nailed along the top of the boards over the canvas to protect the apples from bruising. Shelves for holding the apple box are made at a slant on opposite corners of the table. Extra shelves may also be made under the table for holding wrapping paper and other packing accessories, thus saving a lot of the packer's time by having everything convenient.

Grading.

As the apples are placed upon the table they are generally graded for size and color. It requires as much skill to grade apples well as it does to pack them well. Grading is sometimes done by machine, but machine grading is not entirely satisfactory at present. An amateur starting to grade for size should have a thin board convenient, with holes of the different diameters cut in it. Occasionally, when in doubt, he can try the apples in the different sized holes. It takes a great deal of practice for one to become an efficient grader, although some people learn very rapidly. Two men can pack to good advantage at one table. One may pack a certain size while the other is packing some other size, thus keeping the table fairly well cleaned off.

Lining the Box.

The box is lined on the bottom, sides and top with pieces of paper each 17¾ by 26 inches for the Standard box and 19¾ by 26 inches for the Special box. These are placed so that they overlap about 2 inches in the bottom of the box. They are long enough to cover the sides and the top, lapping over about 2 inches when the box is packed. The ends are rarely lined. Many growers crease these papers where the sides meet the bottom, which is really the top of the box, so that when the bulge is pushed down the paper will not be torn. The paper costs about 7 cents per pound.

Wrapping.

All apples should be wrapped in tissue paper. This helps to retain the moisture content of the apples and also makes a cushion between them. In case an apple should decay the paper also prevents the rot from spreading. Apples also pack more firmly when wrapped. Wrapping paper can be obtained either plain or printed. Oftentimes the large orchardists have their brand or trade name printed upon the wrapper. This makes it cost a little more, but it is a good form of advertising. The white tissue is the best, although different colors are used. It comes in different sizes, which are used according to the size of the apples. The common sizes are 9 by 9 inches, 10 by 10 inches and 11 by 11 inches. Supplies of the three sizes should be kept on hand; the 10 by 10 inch size, however, is most largely used.

Many beginners at apple packing have difficulty with the wrapping of the apple. Wrapping methods vary among different packers. The points sought for are speed and an attractive appearance when wrapped. The paper is taken with the left hand towards one corner. The apple is placed in the paper, blossom end down; the four loose corners are folded in; the left hand places the apple in the box. By placing the blossom end downward in the hand, the surplus loose corners are wrapped around the stem end, thus protecting the apples with which it may come in contact.

Layer papers are used in the top and bottom of the box inside of the lining paper; they are also used between the layers of apples, in order to raise the height of the pack when necessary. It comes in different colors and weights, but a medium weight, white, rough cardboard, 17½ by 11 inches for the Standard box and 19½ by 10 inches for the Special box, is the best.

A shelf should be made to put on the apple box to hold the wrapping paper, such as is seen in Fig. 4. Thumb-cuts should also be provided to put upon the thumb of the left hand for grasping the single sheet of wrapping paper.

Packing.

The packer is now ready for work. He stands in front of the box, with wrapping paper on the shelf and apples at his right upon the table. With his left hand he grasps a sheet of wrapping paper at the corner, while with his right he grasps a certain sized apple which he is about to pack. The experienced packer knows at a glance what pack he must use to have every apple tight in the box, and also how many apples he will need to pack the box.

There are three systems of packing in use, the straight, the diagonal and the offset. The diagonal, however, is used almost entirely. It is the hardest to pack, but it is by far the most attractive and the most efficient. Apples in a square pack generally become bruised in shipment, because each apple is placed directly over the other. Apples may vary more in size in diagonal packing than in square packing; they also tend to bruise much less in this pack, because each apple rests in the space between two or four others. The offset pack presents more empty space to the critical purchaser when he takes off the side of the box to look at the apples; therefore it should be used only when necessary.

The size of an apple is always considered as the greatest distance from cheek to cheek, and not the distance from stem end to blossom end. A well-packed box of apples should always have a bulge of ¾ inch upon both top and bottom. The top and bottom bulged in this way act as springs to hold all the apples tightly. This bulge is most easily attained by selecting apples with a little greater diameter for use in the middle of each layer. As the box is packed this bulge will be about 1½ inches in the middle, but when the bottom is nailed on, the top of the box will spring out, thus making both top and bottom equal. (See Fig. 5 for illustration of bulge.) The pack should be but little in excess of the height of the box at the ends. This generally comes all right because of the size of the box and the kind of pack selected for the several sizes of apples. Apples which have a diameter of 2⅜ inches make a five tier pack of either 188, 198, 200 or 225; 2⅝ inches in diameter make a four and a half tier pack of either 138, 150, 163 or 175; 2⅞ inches in diameter make a four tier pack of either 113 or 125; 3⅛ inches in diameter make a three or two and a half tier pack of either 36, 48, 56, 64, 72 or 80. The number varies with the variety, caused by their different shapes and thicknesses. The regular Standard box is 10½ by 11½ by 18 inches, and can be used for nearly all of these packs.

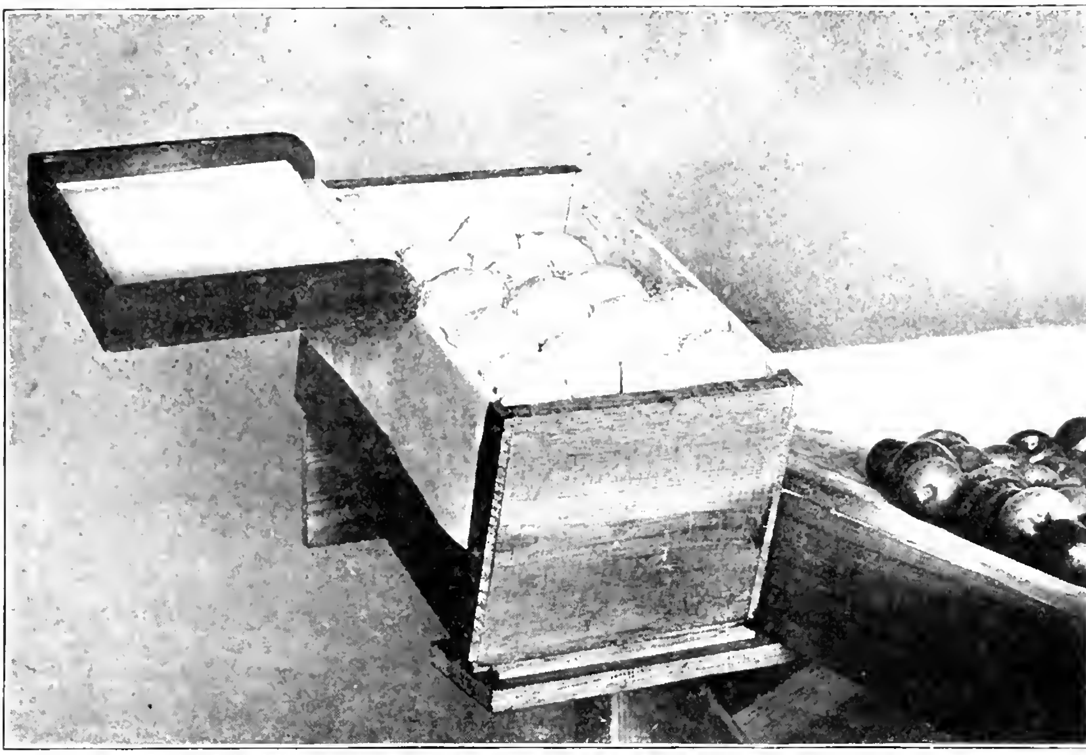

FIG. 4. — Box partially packed, showing construction and position of hod.

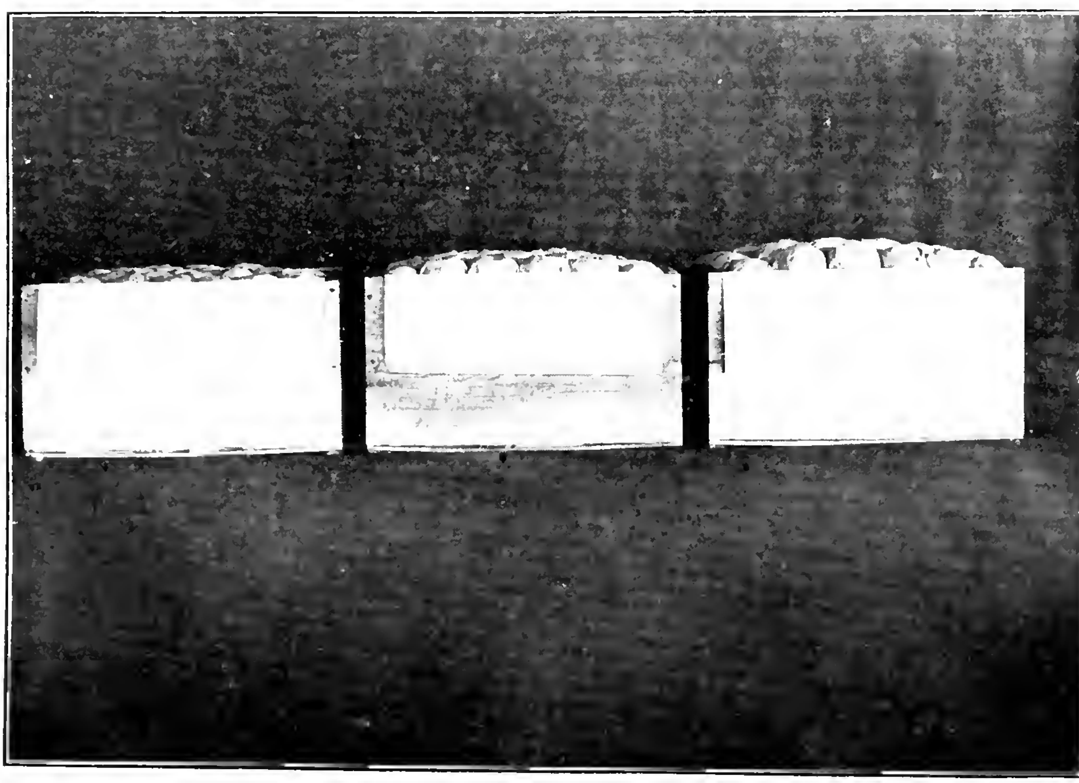

FIG. 5. — The bulge. The box at the left shows too little bulge, the one in the center the proper bulge, and the one at the right too much.

It is sometimes a hard question for beginners to decide when to use the different packs, such as the 4–4, 4–3, 3–3, 3–2 or the 2–2. This varies with the size of the apple being packed, the size of the box and the variety of apple. The 2–2 and 3–2 are the packs most in favor among fruit growers. It is advisable to pack the apples upon their cheeks (Fig. 6) whenever possible, as they present a much better appearance. A few of the varieties and sizes require stem-end packing (Fig. 7). Experience and long-continued practice will overcome most of the difficulties experienced by beginners in box packing.

In the 2–2 pack (Fig. 6), start by placing one apple in the lower left corner and another apple half way between the cheek of the first apple and the opposite side of the box. The next two apples are placed into the equal spaces formed by the first two apples. In Fig. 6 the first apple in the fourth row has slipped down. It should show a space between the apple and the end of the box. The operation of placing two apples in the cavities left by the last two apples should be continued until the top of the box is reached. The layer of apples should be pulled down towards the paper which will then leave sufficient space to insert two more apples. These last two apples will cause all the others to become firm in the box. If the apples are of such a size that layer papers are necessary to raise the height of the apples, a paper is inserted after the first layer is complete. The second layer in the box is packed in the same way, except that the first apple is placed in the lower right corner. This means that all the apples in this layer are placed in the pockets formed by the apples in the first layers, and that when the box is nailed no apple will be bearing the entire weight of any other apple. Each succeeding layer is packed in the same way, being careful that each layer is started so that the apples will be in the pockets formed by the apples of the preceding layer.

The 3–2 pack is very similar to the preceding 2–2 pack, except that three apples are used in alternate rows instead of two. This means that the 3–2 pack requires a much smaller apple. Fig. 7 shows this method packed stem-end instead of cheek. This pack is started by placing one apple in each lower corner and one in the center of the space between these two apples. Two apples are next placed, partly filling the cavities formed by the three apples. These two apples leave three cavities which are filled by three apples, etc., until the first layer is completed. In starting the second layer, two apples are used, then three, etc., thus filling the small pockets formed by the apples in the lower layer.

The 4–4 pack is the square pack (see Fig. 8). The apples must be of such a size that four of them just fit into the box across the end. These are placed, and then four more, etc., until the layer is completed. The next three or four layers are packed in the same way, which means that every apple except those in the upper layer of the box must bear the entire weight of one or more apples above it upon its cheek. This invariably means a blemish upon the cheek, which immediately lowers the price.

The offset pack (see Fig. 8), generally a 3–3 pack, is started by placing three apples with their cheeks firmly together, with these firmly against the left side of the box. This will leave a space between the last apple and the right side of the box; start the next three apples in this cavity. Place two more against this first one in the same way, which will leave the cavity upon the left side. Continue this procedure until the layer is completed. The second layer is started from the right side, and the remaining layers alternate until the box is completed. In packing apples upon their cheeks always pack them with their stem ends pointing toward one of the ends of the box.

After the box is packed a layer paper is placed upon it, the ends of the lining paper which have been hanging loose on the side are folded over the apples, the box taken to the box press and the bottom nailed on. Box presses are upon the market and can be purchased very cheaply. Oftentimes they are made at home.

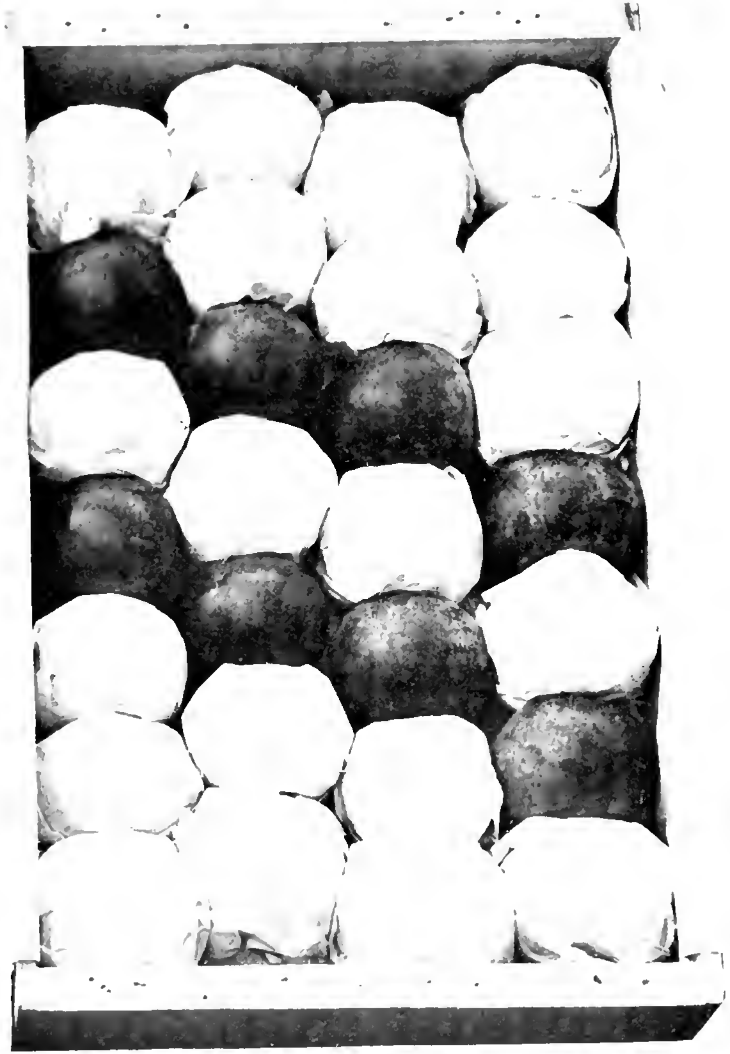

FIG. 6. — 112 pack (2-2 cheek).

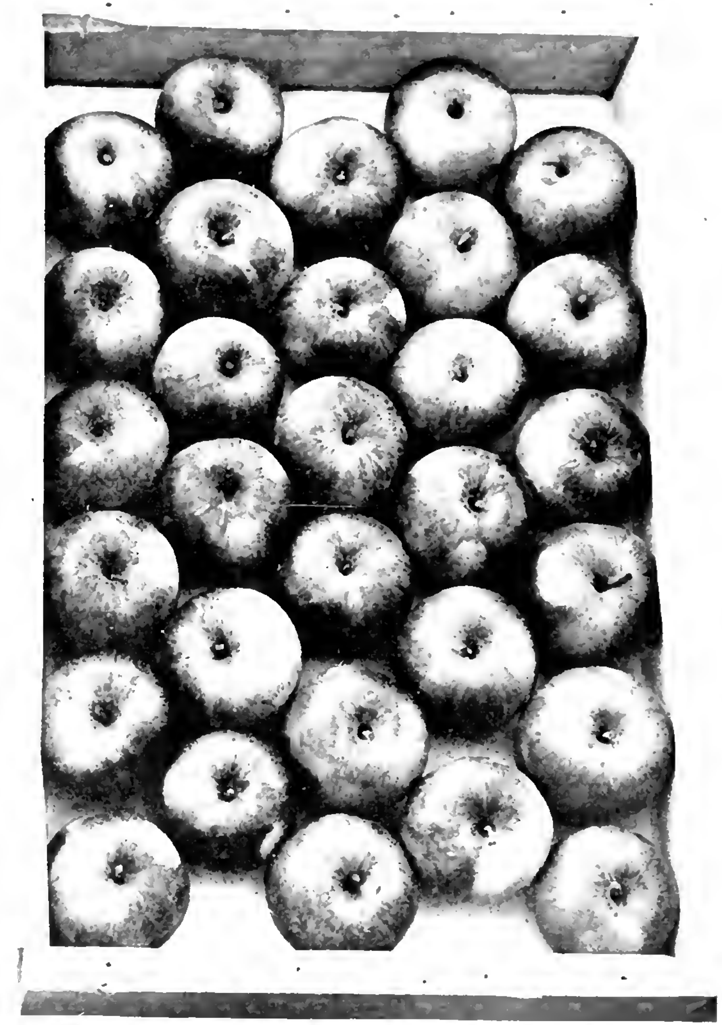

FIG. 7. — 150 pack (3-2 stem).

FIG. 8.—The different kinds of packs. Beginning at the left, (1) offset; (2) square; (3 and 4) diagonal.

Labeling.

Every grower who puts up fruit fit for box packing should have a label to paste upon the end of his apple boxes. The label should be stenciled with the class of fruit, such as "Fancy" or "Extra Fancy," in the upper left corner. The number of apples in the box should be placed in the upper right corner. The variety of apples can appropriately be placed between the two upper corners. Boxes when piled upon each other should always be placed upon their sides. They pile better and the fruit is not damaged by this method.

Other difficulties experienced by beginners at apple packing will be overcome by intelligent study and continued practice. A grower who uses the box package for marketing his strictly high-quality fruit ought to net a larger profit than if he marketed it in the large, bulky barrel. The box package has succeeded wonderfully with the progressive western fruit grower, and is also finding favor with the up-to-date eastern grower who does not make the mistake of using inferior grades.

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1913.

LIST OF CIRCULARS PUBLISHED BY THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

No. 1. Food Value of Milk.

No. 2. Insecticides, Fungicides, and Directions for their Use.

No. 3. Balanced Rations for Dairy Stock.

No. 4. Apple Packing for Massachusetts Growers.

No. 5. Pork Making for Massachusetts Farmers.

No. 6. Three Common Scale Insects.

Approved by
The State Board of Publication.

PORK MAKING FOR MASSACHUSETTS FARMERS.

A long-neglected industry promises rich returns under modern methods.

DR. GEO. M. TWITCHELL, AUBURN, ME.

Among all the specific lines of farm work, whether cropping or breeding, none is more stable or certain to return a generous per cent, year by year, upon the outlay, than pork making, yet throughout Massachusetts no branch of agriculture is so much neglected. Here and there single individuals, or corporations, have engaged in the business, but all the while we face the fact that the State does not produce pork products sufficient yearly for one week's supply for its own inhabitants.

What is true in Massachusetts holds throughout New England. All the while men are running here and there searching after some avenue into which energies may be directed and success insured.

We have passed out of the era of low prices for any meat product, and with our steadily increasing population there is no prospect of any permanent reduction below present standards. For these reasons it is perfectly safe to figure the industry upon the prices of 1911 and be certain that fluctuations will insure just as good an average, and probably better. With these fundamental facts recognized, surprise increases as one contemplates, on the one hand, the possible sure returns, and the almost total lack of recognition of the same by the rural inhabitant, on the other.

MODERN METHODS A NECESSITY.

The greatest stumbling block in the pathway of the average man who contemplates the possibilities of pork production is the old-fashioned pigsty. Habit is so exacting that its full force can hardly be imagined. The pigpen must go, before pork making can become either a lucrative or even an attractive industry. It is one of the relics of olden times to which New England clings tenaciously. Pork may easily be made the cleanest, sweetest and most healthful of all the meat products. Naturally the hog is one of the neatest of animals, so that in judging the industry it must be from the viewpoint of the man who conforms to the demands and conditions of to-day.

Economic pork production hinges upon the utilization of forage crops, the pasturing of the herd and the cutting out of all purchased grain. The problem is, can this be made effective in actual practice as in the west? Here is the crux of the whole situation. Fortunately, we have the experience of a number sufficient to maintain the claim.

Methods of utilizing Forage Crops.

One acre in forage crops will provide all the food wanted by eight well-grown brood sows, and one-half acre in rutabaga turnips and mangels will supply the bulk of food for winter, until we approach farrowing time. Add to this clover hay and a minimum amount of grain and we have an ideal winter ration. How much grain will be demanded cannot be stated in pounds or bushels because of the individuality of the animals and difference in digestive and assimilative capacity. This grain should be corn chiefly, and experience will determine the amount required to supplement the roots and clover, the purpose being to keep each brood sow in healthy, growing condition. While good results will follow the pasturing of a herd on an acre sown to rape, clover and barley, at the rate of 3 pounds of dwarf Essex rape, 7 pounds of red clover and 1 bushel of barley, I am convinced that the plan outlined by Commissioner Huson of New York, and practiced yearly by him, is more economical and will insure better results.

The first is the plan followed at Elmwood farm, when I was in charge there, and which gave surprising returns. Mr. Huson divides this acre into three or four paddocks, with movable hurdles thirty inches high. In September he sows rye in one and turns onto that in early spring, where the shoats thrive wonderfully. By the time it is gone over, but not eaten too close, the paddock of rape, sown in early spring, as soon as the ground is warm, is ready. Then follows one of clover and then one of oats and peas. By the time these have been fairly eaten down the rye will have come again and matured a fair crop of grain, every kernel of which will be utilized. Naturally, the process of change from one paddock to another will be modified by the conditions, the best results obtaining when excessive growth is checked by changing from one to another and each one watched to see that it is not eaten too close. Of course the amount of ground demanded will be determined by the number of hogs kept, but this process of supplying the most healthful and cheapest food possible is so simple that it must commend itself to every would-be pork maker. March pigs grown in this way should be ready for market in October, requiring only enough grain to be carried along steadily, and finally finished in short order for the early market. For this finishing, corn and pumpkins, grown alongside the paddocks, constitute the best and most economical food to be obtained, reducing cost of production and labor of feeding to the lowest dollar, while insuring a quality of product impossible to mature in close pens or with swill-fed animals. The whole problem of profitable pig production hinges on one's ability to minimize cost, both of labor and purchased grain, and, at the same time, feed to insure steady growth. For this reason the growing of the finishing crops alongside the summer pasture must commend itself to every business pig grower. The first step is to grow a strong, bony frame, with abundance of flesh and muscle. This insured, the cost of finishing may be reduced by restricting the range, care being taken at all times to keep everything clean and make certain a bountiful supply of fresh water. We not only want fat, but it must be hardened for market. The inexpensiveness of a crop of pumpkins, and their value in promoting growth, as well as their general tonic effect, make them an ideal food to combine with corn. If the pumpkins and corn are grown alongside the pasture, the whole expense of handling and feeding is minimized, the labor item being confined to cutting and throwing over the fence. To turn the drove into this field might save labor, but the loss from corn and pumpkins trampled upon and wasted would be heavy. If by any other combination of rations the same rapid fattening can be insured at less expense, then surely it should be followed, the whole problem being to obtain most rapid growth towards the market at the least expense. Two possible dangers to be avoided are those of not feeding at regular hours or the attempt to save in quantity. Either will prove suicidal. Instead, the effort should be to so feed as to encourage the largest consumption consistent with health. No arbitrary rules can be given, as much depends upon the eye and hand of the feeder.

There is good evidence in support of the claim that one has but to establish himself in this industry, by some such plan as here outlined, freeing his stock entirely from the old-time methods of pigsty or barn-cellar growing, and advertising a healthy product made only on forage crops, in open pastures with home-grown grain, in order to insure a permanent market at advanced prices. The absolute purity and cleanliness of the product, and freedom from all possible taint of impure surroundings and stale swill feed, will attract buyers. It will be understood here as everywhere that an abundance of fresh water *must* be available at all times, and if possible it is best to equip a field in close proximity to a brook or within easy access to a water supply. In this way the labor item during the growing season is practically eliminated. The best cure for disease is prevention, and that will practically be insured by the plan here outlined. Disease lurks in filth or is carried in decayed food. Fresh air, sunshine and pure water are germ destroyers. But behind the problem of feeding lie some important factors, not one of which can be overlooked.

Type and Breed.

Too many start with or breed from immature sows. The hog of to-day bears but a slight resemblance to its early ancestors. The process of elimination and intensification of traits, form, growth, etc., coupled with the law of environment, has resulted in a creature radically different from the long-nosed rooter of years ago or the razorback of the south. To be a successful breeder one must enter fully into an appreciation of the changes resulting in what we see to-day, and be prepared to push the wall of opposing forces still further into the background. So tenacious is the law of reversion that there is demanded a firm grip and steady hand to insure improvement. The question of breeds is here as elsewhere secondary to type. The pork maker wants a pig which, given right conditions, will make from 175 to 225 pounds of dressed product in six months. First of all, we want the long-bodied, deep barreled, strongly built sow, with a broad, intelligent face, a docile, quiet disposition, the ability to consume a large quantity of food and certainly to supply an abundance of milk for a litter of generous dimensions. Breeding White Chesters I found that some sows would produce 12 or more, at every litter, while own sisters brought but 7 or 8; also that these large producers would give 2 or 3 pigs or more, which, at four weeks, would weigh 25 pounds, with the balance following closely, while the best I could do with others was 18 or 19 pounds.

It takes a trial trip to gain this information, but a man has himself to blame if he gets a second dose. Blood alone does not insure type desired, though strains of each of the breeds have this well established. Here is where experience is the best teacher. Naturally, enthusiasm will center about the breed which pleases the eye, be it black or white, but pork makers to be profitable must never lose sight of the standard of utility which must always center in type adapted to purpose. Looking for special results, a specialized animal is demanded, one bred and built for rapid pork making. Brood sows which are worth using as mothers are worth keeping so long as they will produce. It is ruinous policy to change yearly. Keep a sow as long as she is rugged and productive. Surely no one can justify the use of a grade boar while he may succeed well with grade sows. In a boar look first of all to the character, type, production and disposition of his ancestors on both sides. Finding these to be satisfactory, what of the animal himself? Is he strong on his legs, compact rather than long in body, massive in shoulders, with good hams, and, above all, does he possess the shape and character of head wanted in the profitable meat maker? Did he come from a dam noted for large litters of strong, healthy pigs? After making the selection test him, and, if satisfactory, keep him as long as he is of service. Beyond that when the time comes to change be sure and get another of the same breed and still better in every essential. The trials, troubles and disappointments of would-be pork growers may very largely be traced to the use of immature sows or boars, or an almost total neglect of the laws of breeding in making selection. The single fact that one, or the other, is a Chester, Berkshire, Poland China or Yorkshire proves very little, simply for the reason that so many who breed what they term pure-bred stock, either fail to register same or neglect the essential principle of worth and cling to blood alone. On this rock thousands have gone down who aspired to be known as breeders. There is a blood inheritance, which, backed by individual merit is of transcendent value, and this alone will satisfy or recompense the breeder. No man looking for the dollars through cheap pork production can afford to mix breeds. Price in a boar bears slight relation to value as a sire. Important as is breeding it must always be backed by good feeding, health and vigor being the goal one is seeking.

Care at Farrowing Time.

The evils and troubles of pork raising can, in the great majority of cases, be traced directly to want of proper food or care. Especially is this true at farrowing time. If, in every pen where brood sows are kept, there is a small box constantly supplied with 1 bushel of charcoal, ½ bushel of ashes, 1 peck of salt and 4 pounds of sulphur, mixed together, there will be little danger of trouble at this critical period.

Sows eat their pigs because of an unsatisfied craving, the result of unbalanced and improper rations. When the time comes to separate the brood sows and place them in pens, with guardrails all around, the time has also come to change the feed, and from now on middlings should form the bulk given, with some vegetables to keep the bowels in good condition. Not until close to farrowing should excess of sloppy food be given. If the sow has been handled gently all along she looks upon her care-taker as a friend. Not a day should pass without a visit to the pens and a few moments devoted to scratching her back. Then, when the little pigs come, she will not be disturbed by your presence, and many accidents will be avoided. It is these seemingly trivial steps which tell mightily in profitable pork production.

If a litter of pigs is farrowed early in March, the sows should be ready to breed in September, though some wait one year, believing that they will be more productive and the offspring larger.

Very much depends upon how the pigs are reared. If kept growing from the first, and in good condition, not fat, they will be ready to take up the duties of pig bearing so as to bring their first litter at twelve to thirteen months of age. No rigid rule can be laid down, so much depending upon the owner. No sow should be kept for breeding unless she be growthy, healthy, vigorous and full of life, with body of good length and depth. Never use a weakling or one that has halted in the least during the period of growth. The rule is that nature is lavish in providing teats for a large family, and surely no wide-awake breeder would use a sow deficient in this respect. Many are the little details a breeder must have in mind if he is to succeed, and not one can be neglected.

Care of Pigs.

In every pen there should be a slatted partition arranged, to be lifted up and dropped easily. After the pigs have had their breakfast, lift this and drive them under, then drop in place. They are with their mother, yet separate from her, and the exercise sure to follow an attempt to get with her will do much to ward off disease and promote vigor and strength. Repeat this again in the afternoon, but surely allow the family to be together overnight.

Before two weeks old a small trough should be provided, into which pour a little fresh milk at frequent hours, being careful to thoroughly cleanse each time before filling. Gradually a little middlings may be added, and when the time comes for weaning, the process is simple and there will be no loss. Instead of taking the pigs away from the sow, when six to eight weeks old, remove the sow from the pigs and they will hardly miss her, because they are in the only house they have ever known. It means a big, big loss to put a litter of pigs in strange quarters and have them squeal and starve for a couple of days, when a little thought would save all this. Look well to the teeth of the little fellows, but don't hunt for black ones as the cause of all earthly ills. If any are over sharp and are lacerating the cheek snip off the top with a pair of sharp pincers.

A healthy sow can well produce two litters a year though there is not as much profit in the second as the spring litter, but a little attention should be given to time of their coming. It is well, if the quarters are warm, to have the early litter come the very first of March and then breed the sow again five days after removing her from the pigs. This would allow for them to run with her six to eight weeks, and have the second litter come the last of August.

Success Dependent on Type of Man.

There is no chance for a shiftless man to win success in this business, for the details, while not burdensome, are exacting and will not permit of neglect. No man should attempt to keep hogs who does not visit his paddocks or pens daily, who cannot find the right side of a hog and be on friendly terms with every one, and who does not see in the business full scope for all the skill, thought and application at his command. It is a good business for any live man, but one not to be neglected. The measure of profit will depend upon the energy and watchfulness as well as appreciation of the master. From a purely business standpoint pork production may well be urged upon Massachusetts farmers, for, scattered all over the State, there are skilled breeders, of all representative breeds, and full advantage can easily be taken of all expense, study and experience expended by these specialists in building up their strains.

Especially should this business appeal to the man of moderate means, for it is not a difficult proposition for one ton of pork to be produced from the offspring of a single sow in one season, and surely, following the hints here given for production of home-grown food, it comes pretty near a case where a man has his cake and eats it also, for he has his brood sow left for further production, his farm is being improved, and a substantial sum is yearly being added to his net income. Rightly fed and properly treated there is no animal so free from disease as the hog.

Prevention of Disease.

If by any cause disease gets a foothold, radical measures should be resorted to at once to prevent a spread, and to cure the sick. Isolation is the first step to be insisted upon, and that in dry, clean, well-ventilated pens. Then will come the specific treatment given in the bulletins published by the government. Recognizing fully the importance of prompt and thorough measures, it is yet necessary to emphasize again and again the supreme value of prevention of disease by a proper recognition of sanitary and hygienic conditions, and the use of nature's best food products in the making of choice, fresh, delicious pork.

Cost of Production.

Growing the roots, forage crops and corn for finishing, pigs can be grown to six months and to dress from 175 to 225 pounds for 4 cents per pound. We must remember that the rapidly grown young pig gives the best net returns, that it costs much more to gain a pound after six months old than at four, and that the secret of success lies in rapid growth, generous feeding at finishing and an early visit to the block and the pork barrel.

If it were possible to stimulate pork production along economic business lines, so as to supply the home markets of the State, a new life would be injected into every department of agricultural work, and an era of rural prosperity be ushered in such as was never before witnessed. The market is at our doors here in New England; the demand is active; the army of nonproducers increases steadily. There is no possibility for lower prices to be maintained, and this field, open before the energetic home builder, is attractive, permanent and sure to be remunerative in an increasing ratio as the days go by.

Circular No. 6

Supplanting Nature Leaflet No. 33. August, 1913.

MASSACHUSETTS STATE BOARD OF AGRICULTURE.

THREE COMMON SCALE INSECTS.

By H. T. FERNALD, Ph. D.,
State Nursery Inspector.

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THREE COMMON SCALE INSECTS.

BY H. T. FERNALD, PH.D.

Fruit growers often find scale insects (formerly called bark lice) on their trees, and of these there are three kinds which are abundant in Massachusetts. These are known as the San José scale, the oyster-shell scale and the scurfy scale.

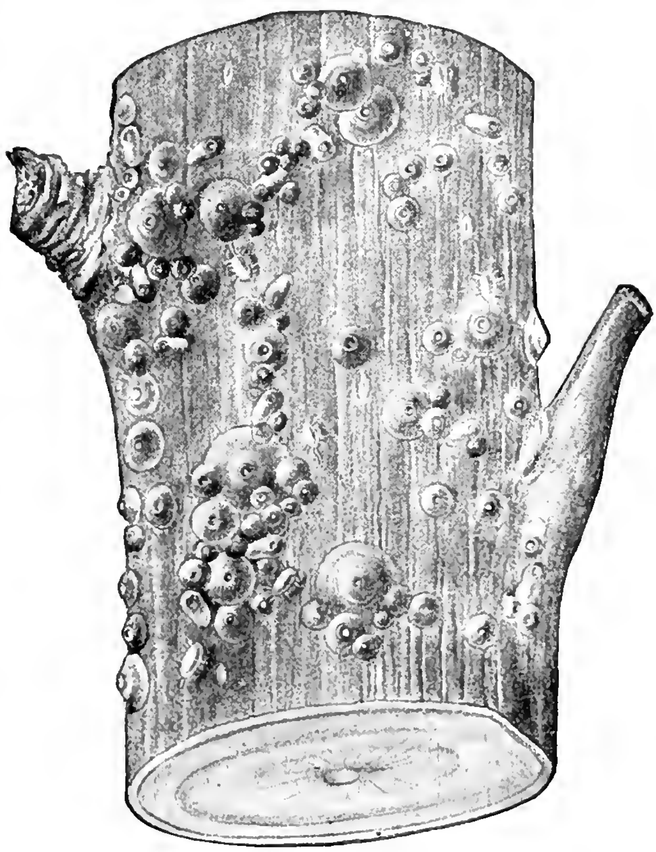


Fig. 1.—Different stages of the San José scale, enlarged five times. (From Virginia State Crop Pest Commission Bulletin, 1904.)

The San José Scale.

This pest, which is the most destructive scale we have, is now generally distributed in the State.

The scale is round (circular) in outline, or nearly so, and when full grown is about as large as a small pin head, highest in the middle and grayish-brown in color. The young are born alive, beginning about the middle of June, and are produced at intervals of two or three days for about a month before the parent dies. The young are very small, yellow, and crawl about for a time till they find a satisfactory place on which to settle. During this time they may crawl on to the feet of some larger insect or bird, and thus be carried to some other tree, where they may crawl off and infest that tree, or they may be blown by gusts of wind on to trees near by. When ready to settle down, they work their beaks into the bark till they reach the sap upon which they feed, then begin to produce waxy, white threads on their backs. These threads soon mat together, forming a circular white scale, and to this are added molted skins as the insect grows. These skins and the action of the weather turn the scale gray or blackish, so that young scales may often show black, white and gray, arranged more or less in concentric rings, though they are so small that this can be seen only under a magnifying glass. In a month or less from the time they were born these young have become mature and in their turn are producing young, and there is accordingly an almost continuous production of young from the middle of June till cold weather begins, the process in Massachusetts usually ending before the first of December. At this time there will be scale insects of all ages on the trees, but all the adults and young scales die during the winter, leaving only those which are half or two-thirds grown. The early spring months are used by these in completing their growth, the adult condition being reached and reproduction beginning, as already stated, about the middle of June.

Treatment.

This pest can be successfully treated only during the winter months. Many different methods have been used, but most of these are either worthless or too expensive to be available.

Trees nearly dead can probably be saved by treatment; but this does not usually pay, it takes the trees so long to recover. In most cases it is better to destroy such trees.

Where treatment is advisable miscible oils and the lime-sulfur wash are now much in favor for this purpose.

Lime-sulfur Wash. — This may be made where it is to be applied, or can be purchased ready made. Apparently the home-made material is slightly the better, but this is often offset by the inconvenience or impossibility of preparing it where it is to be used.

Several formulas have been given for making the wash but there seems to be little difference in the results. One good formula is: —

Lime, ...	20 pounds.
Sulfur, ...	18 pounds.
Water, ...	48 gallons.

As spraying is usually done with barrel pumps holding about 50 gallons, this formula is prepared to fill such a barrel.

The lime used should be the best stone lime, freshly burned, and as little slaked by standing as possible. Finishing lime gives excellent results.

The sulfur should be either flowers of sulfur or sulfur flour; stick sulfur will not do. These materials should be prepared in an iron kettle holding at least 30 or 40 gallons, as follows: Place 6 or 8 gallons of water in the kettle, start a fire under it, and slake the lime, getting this as fine as possible in the slaking. When this is well under way gradually add the sulfur, stirring it in well, and keep the fire going to continue the heat begun by the slaking lime. Boil the mixture, adding water as may be needed from time to time, till the color of the liquid becomes dark orange-red. This should take from forty minutes to an hour, the longer boiling seeming to bring more of the sulfur into solution and leaving less sediment at the bottom of the kettle. When the boiling is completed strain the liquid into the spray pump barrel, using a strainer of copper wire of at least 20 threads to the inch, then add any water necessary to make the 48 gallons, and spray. The cooking is sometimes done in barrels by the use of steam led into them, but for some reason this often fails to give as good results as the use of a fire.

If for any reason this home-made wash cannot be made use of, numerous ready-made lime-sulfur washes are on the market, and can be used with quite satisfactory results.

A concentrated home-made lime-sulfur wash is now being used to quite an extent. The method of making, keeping and diluting this for application can hardly be given within the limits of this paper.

Miscible Oils. — Many orchardists are now using miscible oils — often wrongly called soluble oils — instead of the lime-sulfur wash. A satisfactory miscible oil can be made by the person desiring to use it, but the trouble and time necessary are so great that this is not often done, and the oil is generally purchased, ready for use on dilution with water.

A number of different miscible oils are now on the market, and most of them can be expected to give very good results when not too much diluted and when thoroughly applied. Where the scale is abundant the dilution should not be more than one part of oil to fourteen parts of water, though in order to reduce the cost, directions accompanying these materials often direct that one part of oil be mixed with twenty of water. This generally makes the spray too weak to be sufficiently effective.

General Spraying Directions.

In spraying for scale insects thorough work is necessary if satisfactory results are expected. Only those scales actually reached by the spray will be killed, and a very few left on a tree will be sufficient to heavily restock it by the following fall. Formerly a very fine misty spray was considered the best for the work, less of the material being wasted. At the present time the tendency is to use a coarser nozzle, thus making it possible to drive the spray with more force, and also to cover the trees more rapidly with the same thoroughness as that given by the other nozzle. By spraying in this way the loss of material is more than made up by the saving of time and of wages to the men doing the work.

Spraying for the San José scale should be done during the winter months, while the trees are leafless and dormant. It should not be done after the buds have opened in the spring sufficiently to show a green (or white, in the case of the blossom buds) color, as the spray is so strong that injury may then result.

Many orchardists are now spraying, one winter with the lime-sulfur wash, and the following winter with one of the miscible oils, believing that by an alternation of the two materials better results are obtained. Whatever the material used may be, the spraying should be thorough, and every part of the tree covered with the spray. If windy weather prevents good work, it is often possible to spray one side of the trees and complete the treatment at some later time.

Sometimes summer treatments seem advisable on trees badly affected. In such cases either of the above materials can be made use of, though they should be diluted much more than for winter use.

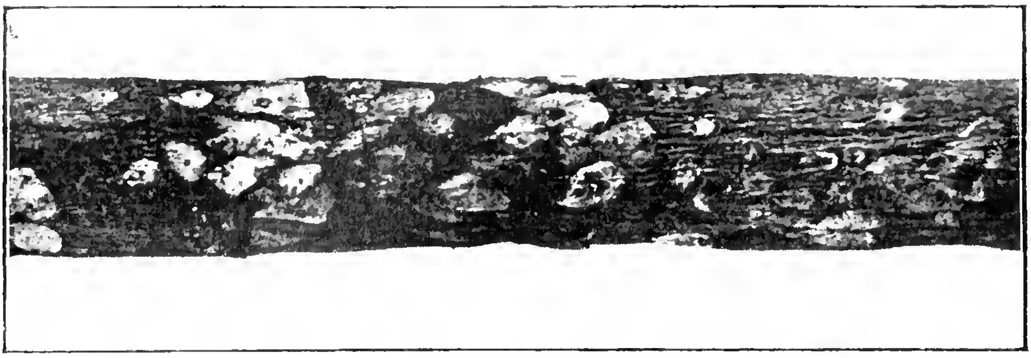
Many other trees besides fruit trees and many shrubs are attacked by the San José scale, but the treatment for these is the same as that given above.

The Oyster-shell Scale.

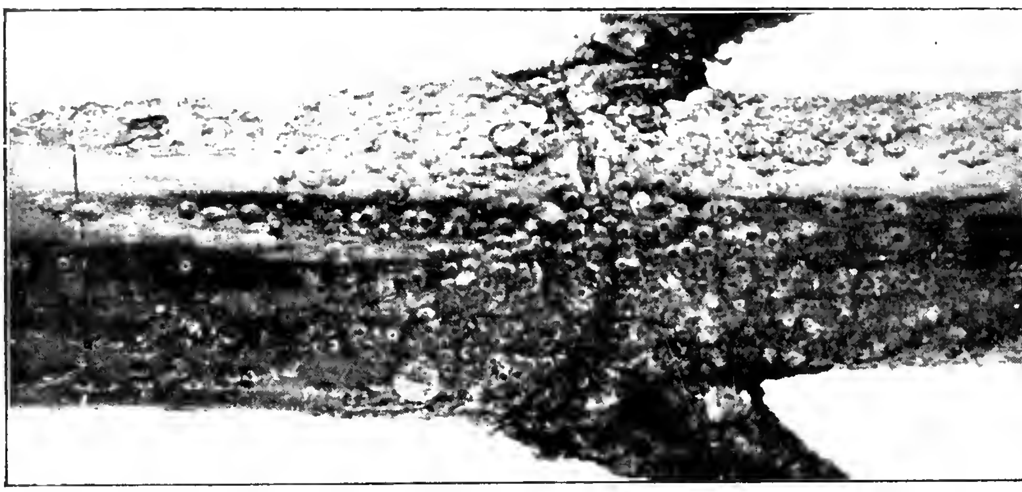
This common pest on apple, pear, ash, poplar and willow trees and lilac bushes is much larger than the San José scale, and is of different form, being long, rather pointed at one end and broader and rounded at the other, and may be curved along its length, the form as a whole suggesting that of an oyster shell, which has given it its name. It is brown or dull gray in color, this last shade being most common on the ash, willow and lilac.

The life history of this scale is so different from that of the San José scale that the treatment for it is also very different.

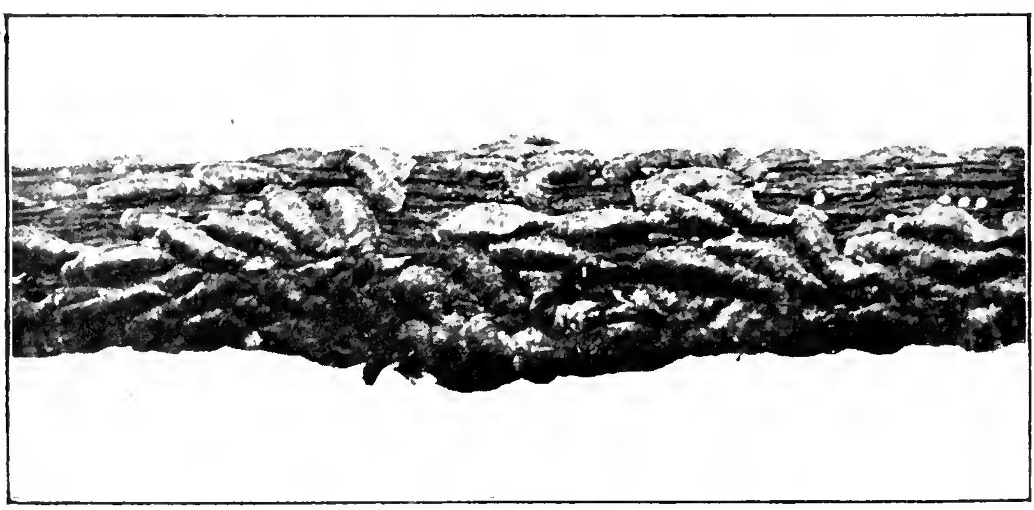
The winter is passed by this insect in the egg. At this time the parent insect which produced the scale lies dead under the pointed end of the scale, and the rest of the space is occupied by from twenty to a hundred tiny whitish eggs. These hatch about the first of June, and the young, which are whitish-yellow, and closely resemble the young of the San José scale, push out from beneath the parent scale and crawl about, seeking for a place to settle and feed. When



The scurfy scale.



The San José scale.



The oyster-shell scale.

THREE COMMON ORCHARD SCALES.—TWICE NATURAL SIZE.

this has been found a scale begins to form over the back of the insect, and by October it has become fully grown, has laid its eggs behind it under its scale and has died. These eggs pass the winter and hatch the following June.

From this it is evident that there is but one brood of these insects each year. Farther south there are two broods a year, and it is possible that there may be two in Massachusetts in some cases, but, if so, it is unusual.

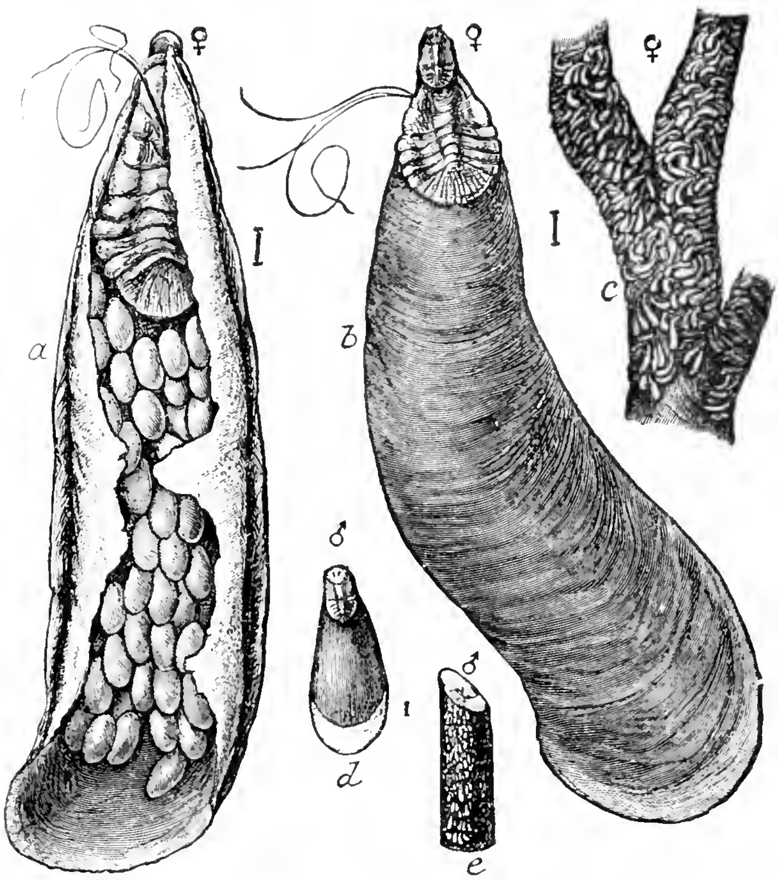


Fig. 2.—Oyster-shell scale: *a*, under side of female scale, showing eggs; *b*, upper side of same, both much enlarged; *c*, female scales on a branch, natural size; *d*, male scale much enlarged; *e*, male scales on branch, natural size. The fine lines to the right of *a*, *b* and *d* show the real length of the scales. (Howard, U. S. Dept. Agr. Yearbook, 1894.)

Treatment.

As the eggs of these scales all hatch about the first of June, this fact may be taken advantage of in the treatment. The crawling young are entirely unprotected by any scale, are soft-bodied, and can be killed by spraying with kerosene emulsion or with whaleoil soap, if taken at the right time. The only difficulty is that in order to be destroyed each one must be touched by the spray, and they are very small. This means that the spraying must be thorough.

Whale-oil Soap. — Whale-oil soap, 1 pound; water, 4 or 5 gallons. Spray thoroughly about the first of June, according to whether the season is early or late, and repeat in from ten days to two weeks. This second application will be likely to reach some which were missed the first time, and also any which had not hatched when the first treatment was given.

Kerosene Emulsion. — Hard soap shaved fine, ½ pound; water, 1 gallon; kerosene, 2 gallons. Dissolve the soap in boiling water, then remove from the fire and pour it into the kerosene and churn with a spray pump, turning the nozzle back into the mixture; continue this till the mixture changes first to a creamy, then to a soft, butter-like mass. This will keep for some time. Use 1 part of this mixed with 9 parts of water to spray. If the water used is hard, the emulsion may not form unless borax or soda be added to make the water soft.

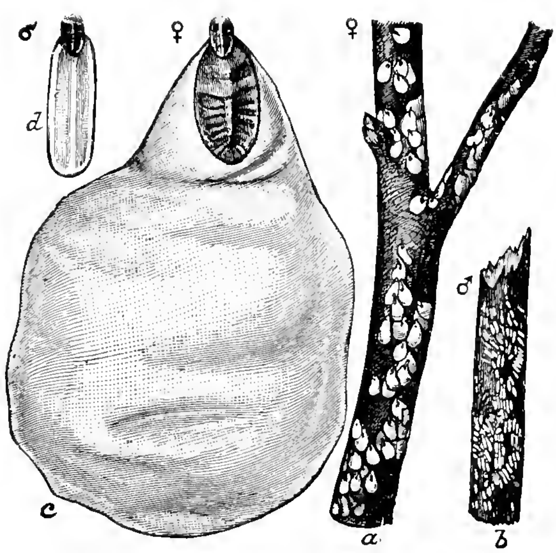


FIG. 3.—Scurfy scale: *a*, female, *b*, male scales natural size, on twigs; *c*, female scale, much enlarged; *d*, male scale, much enlarged. (Howard, U. S. Dept. Agr., Yearbook, 1894.)

THE SCURFY SCALE.

This scale, which is also very common on apple and pear trees, is about as long as the oyster-shell scale, but is broader, rather pear-shaped, and white or grayish-white in color. Its life history is about the same as that of the oyster-shell scale, but the eggs are purple, as are also the crawling young. The treatment is the same as for the oyster-shell scale, and should be applied at the same time.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 7.

November, 1913.

Contribution from the Dairy Bureau, P. M. Harwood, *General Agent.*

THE DAIRY INDUSTRY IN DENMARK.

Reprint of an Extract from "A Short Survey of the Danish Agriculture," Published by the Royal Danish Agricultural Society, Copenhagen, Denmark
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(Edited by P. M. HARWOOD.)

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THE DAIRY INDUSTRY IN DENMARK.

Note. — This article is republished for the purpose of rendering available to Massachusetts people the history and status of Danish dairying from highest authority. Italicized portions are by the editor. 1 hectare (ha.) equals about $2\frac{1}{2}$ acres (2.471059 acres); 1 kilogram (kg.) equals 2.2 pounds (2.204622 pounds); 1 krone (kr. equals 100 ore) equals 26.8 cents; 1 ore equals .268 cents. — Editor.

The dairy industry in Denmark is in reality not very old. Up to about 1830–50, farmers doubted whether dairying paid or not. After 1850 the dairy industry increased more and more and the larger estates took the lead and showed, by experiments and practical measures, that dairying paid. There was no great export, partly because the butter had not yet gained a reputation on the world's market, and partly because they could not make a uniform product, as the many small batches made on the small farms were of a very uneven quality.

Segelcke (1831–1902) contributed very much to the rapid development of the Danish dairy industry. He put in an enormous amount of work as the counselor of the Royal agricultural society, in order to establish a regular and systematic dairy industry. He impressed his ideas everywhere by training and appointing dairy counselors, and made the farmers understand that by proper and intelligent work a good profit could be made by dairying. At the London exposition in 1879 the Danish butter conquered in the international competition, and this result was due chiefly to the purposeful work of Segelcke.

After the introduction of the separator the work was further systematized, and when the first co-operative creameries were started the small farmer, with one or only a few cows, received as much for his milk and became of the same importance as the estate owner with the many cows; and when the farmers realized this, one co-operative creamery after another was erected. That this movement in favor of co-operative creameries became so phenomenal was surely also due to the fact that the creameries were built very cheaply, and hence the farmers were not scared by any great outlays, as it must be remembered that they were not accustomed to have much cash in hand.

This development may best be outlined by the following figures: in 1882 the first co-operative creamery was erected (while the first individual one was started in 1863), and up to 1886 there were erected 86; from 1891–95 it was 169; from 1896–1900 it was 119. The total number in 1913 was 1,188 co-operative and 300 individual or estate creameries, and hence the total may now be put at fully 1,500.

In 1909 there were reported 182,373 herds with 1,281,974 cows, and of these 154,602 herds with 1,059,359 cows supplied milk to the co-operative creameries. The following table shows the support of the co-operative creameries given by farms according to size: —

	Per Cent.	
	Herds.	Cows.
Up to 0.55 ha., *1.36 acres*,	70.1	67.5
From 0.55 ha., *1.36 acres*, to 4.96 ha., *12.26 acres*,	84.9	86.3
From 4.96 ha., *12.26 acres*, to 14.89 ha., *36.79 acres*,	88.1	88.9
From 14.89 ha., *36.79 acres*, to 29.79 ha., *73.61 acres*,	90.3	90.8
From 29.79 ha., *73.61 acres*, to 59.57 ha., *147.20 acres*,	88.9	88.0
From 59.57 ha., *147.20 acres*, to 238.30 ha., *588.85 acres*,	82.8	73.9
Above 238.30 ha., *588.85 acres*,	49.0	38.8

The table shows that only half of the largest estates deliver milk to the co-operative creameries. They either make up the milk at home or contract it to the individual creameries or to the city dealers. The total milk production of the country may be placed at 3,500 million kg., *7,716,177,000 pounds*, and of this about 2,700 million kg., *5,952,479,400 pounds*, go to the co-operative creameries.

The payment for the milk to the members of the co-operative creameries is usually made by calculating the full value for the whole milk delivered and deducting the value of skimmed and buttermilk returned. This value is agreed upon at the general meeting. The statements are made up weekly and the payments are made monthly. As a rule, rather a large amount is left over at the end of the financial year, and this "surplus" is distributed according to the whole milk delivered. This surplus averages for the whole country about 15 per cent. of the payments made to the suppliers. The total working expenses — besides milk hauling — averaged (1912) 8.89 kr. per 1,000 kg., *or $1.08 per 1,000 pounds;* the milk hauling, 3.43 kr. per 1,000 kg., *or $0.42 per 1,000 pounds.* There are, on an average, 156 suppliers and 956 cows per co-operative creamery, and the cows average 2,520 kg., *5,555.65 pounds* milk (against 2,627 kg., *5,791.54 pounds,* in 1911) delivered to the creamery. It took 25.5 pounds of milk to make 1 pound of butter, and the whole milk netted (in 1912) 9.7 ore per kg., *or $0.012 per pound.* The salaries averaged for the same year 1.60 kr., *or $0.194 per 1,000 pounds;* the fuel, 1.04 kr., *or $0.126 per 1,000 pounds* (against 0.86 kr., *or $0.104 per 1,000 pounds,* for 1911), and the maintenance of buildings and inventory as well as renewals, 0.59 kr., *or $0.07 per 1,000 pounds;* all per 1,000 kg. milk.

The co-operative creameries handled, on an average, fully 2.5 million kg., *5,511,555 pounds,* milk annually. The fire insurance averages about 30,000 kr., *$8,040,* and the debts fully 15,000 kr., *$4,020,* per creamery.

Butter is mainly produced, but some cheese is also made either from skimmed milk or from mixtures of skimmed milk and whole milk (10, 15, 25 and 40 per cent., seldom more, whole milk), yet the production is hardly much more than 15 million kg., *33,069,330 pounds,* annually. There is also some cheese made from pasteurized milk and, at times, some casein. There is one milk-condensing factory, erected in 1907 in Nakskov.

While the butter export in the period 1865–69 averaged about 5 million kg., *11,023,110 pounds,* it was in 1880–84 about 15 million kg., *33,069,330 pounds;* in 1885–89 fully 25 million kg., *55,115,550 pounds;* in 1900–04 fully 85 million kg., *187,392,870 pounds;* 1905 made it 93 million kg., *205,029,846 pounds;* 1906 it was 92 million kg., *202,825,224 pounds;* 1907 it was 100 million kg., *220,462,200 pounds;* in 1908 and 1909 it topped with 102 million kg., *224,871,444 pounds;* in 1910 it fell to 91 million kg., *200,620,602 pounds;* and in 1911 it was 92 million kg., *202,825,224 pounds.*

This drop in the butter export during the last years is due to the great increase in the export of milk and cream. This amounted, in 1910, to 23.7 million kg., *52,249,541 pounds,* and in 1911 to 30.45 million kg., *67,130,740 pounds,* valued in 1910 at 11 million kr., *$2,948,000,* and in 1911 at about 15 million kr., *$4,020,000.* In 1909 the export of milk and cream was rather insignificant.

Of the exported butter, however, a part is foreign, which is re-exported, and this amounts to about 12 million kg., *26,455,464 pounds,* while the total import was 15 to 16 million kg., *33,069,330* to *35,273,952 pounds.* It should be noted that all foreign butter must be so marked whether consumed or exported.

The cheese import is, as a rule, about 0.75 million kg., *1,653,466 pounds,* generally a little less, while the export is only about 0.2 million kg., *440,924 pounds,* and thus of no consequence.

There is a law ordaining that all butter made for export must be made from pasteurized cream (at least 80° C.), and it must not contain more than 16 per cent. moisture, nor contain any other preservative than salt. The butter is exported in firkins (1 hundredweight net), with two "Lur" branded staves and the registered number of the creamery. The police and the margarine inspectors control the pasteurization, and the experiment laboratory analyzes the samples sent in by them.

In order to shortly designate the factors which have caused this strong growth of our dairy industry, we must first mention Segelcke (1836–97), and Fjord (1825–91) whose pioneer work as director of the experiment laboratory has been of inestimable value; next, the co-operative movement which united the milk-suppliers, large as well as small, and made it possible to produce large and uniform lines of butter.

The appointment of dairy counselors who, by lectures and inspections of the creameries and by acting as judges at exhibitions, have done, and surely continue to do, a great educational work, is also a factor of importance. Furthermore, the expositions where the products are scored by the merchants, the counselors and the buttermakers jointly are also of great educational value. We have essentially three kinds of exhibitions, namely: —

1. The pail shows of which each locality arranges 6 to 9 annually. The butter is scored about fourteen days old and is ordered in without previous notice (surprise tests). The written judgment is returned to the creamery with the butter.

2. Provincial exhibitions which are made once a year in each of the three provinces, Jutland, Fyn and Seeland-Lolland-Falster. At these the creameries know the time beforehand, and hence they are in reality only a trial of what the buttermakers can do when put on their mettle. At the same time there are exhibited cheese and dairy machinery and supplies. Instructive lectures about the butter, cheese and machinery display are delivered and sometimes is added a popular instructive subject.

3. The experiment laboratory butter scorings take place, as a rule, once a week, and since January, 1912, have been compulsory for every creamery desiring to use the "Lur" brand and thus produce export butter. The creamery, accepted for control, is obliged, without previous warning and on written or wired order, to send in immediately a firkin of its finished butter to be scored. The butter is scored when fourteen days old by 9 judges (merchants, counselors and buttermakers) in three sets. If the butter from a creamery is of poor quality (under the proclamations by the agricultural department of Nov. 18, 1911, and July 8, 1912) the right to use the "Lur" brand may be canceled until the production is again of good quality. If there is more than 16 per cent. moisture in the butter

the "Lur" brand on the firkin is at once obliterated and the butter may then be sold only at home as "waterbutter."

Finally, the milk-scoring associations must be mentioned. Their aim is to score the milk arriving at the creameries either by a special milk judge or by the manager. The milk is classified and, in many creameries, a little more than the average price is paid for the good and a little less for the poorer milk, and the supplier is thus spurred on to deliver a better quality.

The Commonwealth of Massachusetts.

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CONTRIBUTION FROM THE DAIRY BUREAU, P. M. HARWOOD, *General Agent.*

COST OF MILK PRODUCTION.

BY FRED RASMUSSEN, PROFESSOR OF DAIRYING,
NEW HAMPSHIRE COLLEGE OF AGRICULTURE AND
THE MECHANIC ARTS, DURHAM, N. H.

BOSTON:
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COST OF MILK PRODUCTION.

BY PROF. FRED RASMUSSEN.

No manufactured article will for any length of time be sold below the cost of manufacture. Milk is a manufactured article, being manufactured or produced by the dairy farmer. For several years great quantities of milk have been sold by the farmer below the cost of production, which fact accounts for the unsatisfactory dairy condition existing to-day in many sections of Massachusetts and other New England States. Because it proved unprofitable, not one but hundreds of dairy farmers have discontinued the production of milk.

A farm is in some respects like a department store, in which, unless accurate accounts are kept, one department often pays the deficit of another. Farm operations are very closely interrelated and nearly always merge into one another. Only people who have tried to keep records know what a difficult problem it is to keep even approximately accurate records of all work and transactions on the farm. This fact as much as any other is responsible for the universal lack of comprehensive records to be found on farms.

The New Hampshire Experiment Station has for the last two years studied the cost of milk production in the State of New Hampshire, and has been able to obtain, through the records of the Lyndeboro Cow Test Association, figures on the cost of production in the section covered by this association. Complete records have been kept of 326 cows distributed in 26 different herds. The amount of milk and butter fat produced, and the cost of feed consumed, by these cows are known. Estimates of cost of buildings and equipment have been made, and records have been kept for other factors entering into the cost of milk production. The average production of the 326 cows was as follows: —

Yearly Average of 30.18 Cows.

Average number of pounds of milk per cow,	6,463.20
Average number of pounds of butter fat per cow,	243.60
Average value of milk per cow per year,	$116 42
Average cost of feed per cow per year,	$73 03
Average return per cow per year above feed cost,	$43 77
Returns for each dollar's worth of feed consumed,	$1 59
Average cost of feed to produce 100 pounds of milk,	$1 13
Average cost of feed to produce a quart of milk (cents),	2.40

The conditions for an economic production from these herds were a great deal better than the average New Hampshire conditions (1) because the cows were above the average found in the State (the United States Department of Agriculture, in co-operation with the New Hampshire Experiment Station in a field survey of four towns in Hillsboro County, including South Lyndeboro, found the average production to be 5,062 pounds per cow, while the average of the above-mentioned herds was 6,463.2 pounds); (2) because the farmers during the year had a monthly opportunity of receiving expert advice on feeding and other factors entering into the economic production of milk (the discussions also at the monthly meetings showed that the majority of the farmers were feeding liberally and were studying the whole proposition of economic milk production); (3) the fact that 103 cows were sold before the end of the year (most of them because they were found unprofitable) tends to show a higher production and a higher profit per cow than if they had been kept throughout the year.

Summary of Cost of Milk Production.[1]

The following is a summary of the expenses entering into the annual cost of production per cow on a 20-cow dairy farm: —

[1] Detailed information is found in Extension Bulletin No. 2, New Hampshire Experiment Station, Durham, N. H.

Cost of feed,		$73 03
Labor,		32 33
Delivery,		7 18
Housing,		9 05
Depreciation on cow,		8 83
Bedding,		4 00
Bull,		3 79
Taxes and interest,		4 55
Ice, and coal and wood for heating,		2 17
Veterinary service and medicine,		87
Tools, utensils, salt, etc.,		53
Cow Test Association, expenses per cow per year,		1 40
		$147 73
Credit.		
Manure,	$15 00	
Calf,	3 00	
		18 00
		$129 73

The total cost of keeping a cow under farm conditions as found in New Hampshire is $147.73; of this amount $73.03 represents the feed cost, while other expenses, or what may be termed "fixed charges," represent $74.70, or in this case one-half of the total cost.

To offset the total cost of keeping a cow are the following factors: (1) the milk produced; (2) the manure; and (3) the calf.

The value of the manure and calf is considered equivalent to $18 per year; subtracting $18 from $147.73 leaves $129.73, the balance to be covered by the milk produced. In other words, it costs $129.73 to produce 6,463.2 pounds of milk with an average of 3.76 per cent. fat, *or 4.3 cents per quart.* The fact that 103 cows found to be unprofitable were sold before the end of the year makes the average production higher and the cost of production lower than it would have been if these cows had been retained for the whole year.

Production Necessary for Profit.

As the average price for milk in the different zones varies, the following table will make it possible to make comparisons for prices between 40 and 24 cents per can, or 4.7 and 2.8 cents per quart: —

Average Price per Quart.	Amount.	Number of Quarts.	Number of Pounds of Milk.
$0 047,	$129 73	2,249.9	5,837.4
044,	129 73	2,392.2	6,143.4
042,	129 73	3,016.4	6,485.4
040,	129 73	3,198.6	6,867.0
037,	129 73	3,394.0	7,297.2
035,	129 73	3,620.0	7,783.2
032,	129 73	3,878.7	8,339.4
030,	129 73	4,176.8	8,980.2
028,	129 73	4,525.1	9,729.0

From the records obtained by the Lyndeboro Cow Test Association it seems clear that a mature cow to be profitable must produce 6,000 to 8,000 pounds of milk per year, depending upon the price obtained. Since this amount is considerably above the average production, a large number of the dairy cows in New Hampshire are apparently kept at a loss.

Cost of Production under Average Conditions.

The last census report shows the average production of milk per cow in Massachusetts to be 4,524 pounds; in New Hampshire, 3,775 pounds; in Vermont, 3,982 pounds. No doubt the actual production in the several States is higher than this. In the writer's opinion a more nearly correct estimate is between 5,000 and 5,500 pounds of milk.

To get conditions which will represent average production for Massachusetts, New Hampshire and Vermont let us take the 39 cows of the 26 herds studied producing between 5,000 and 6,000 pounds with an average production of 5540 pounds of milk.

The cost of production will be as follows: —

All items of expense as given on page 5 will be the same, except the cost of feed, the cost of delivering the milk to the station and the Cow Test Association expenses. These three items represent a difference of $6.12 for the cost of the feed, $1.02 for the delivery and $1.40 for the Cow Test

Association expenses, or a total of \$8.54. Subtracting \$8.54 from \$129.73, the total average cost (see page 5) leaves \$121.19 as the expense per cow per year. Milk to the amount of 5,540 pounds equals 2,462.2 quarts,[1] or, in other words, it costs \$121.19 to produce 2,462.2 quarts of milk, or *4.92 cents per quart.*

At a selling price of milk ranging between 30 to 40 cents per can, or from 3.7 to 4.7 cents a quart, the farmer no doubt is selling milk below the actual cost of production.

Comparison of Increase in Cost of Production with Increase in Price obtained by Farmer.

The following table shows the increase in the cost of the most common feeds and the increase in price of milk to the farmer and the increase in price to the consumer in 1904 and 1912.

Prices for hay have been obtained from reports of Boston Chamber of Commerce. Prices for grain have been obtained from a table compiled by J. B. Lindsey, Massachusetts Agricultural Experiment Station. The price of milk per quart to the farmer is the price paid in the middle zone by one of the largest milk contractors in Boston. The price paid by the consumer is the price paid for milk delivered in glass for family use in Boston.

Article.	Prices in **1904.**	Prices in **1912.**	Increase in Per Cent.
Hay, grade No. 2, per ton.	\$13–\$16 50	\$21 50–\$28	57.7–64.7
Linseed meal per ton,	25 17	39 30	56.2
Distillers' grain per ton,	24 31	39 94	35.5
Bran per ton,	20 87	27 96	34.4
Gluten feed per ton,	24 24	31 51	29.9
Corn meal per ton,	23 68	30 20	27.5
Cottonseed meal per ton,	26 52	31 20	17.6
Milk: —			
Farmer's price per quart (cents),	3 24	3 90	20.4
Consumer's price per quart (cents),	7 50	9 00	20.0

[1] An average quart of milk weighs approximately 2.15 pounds. Owing, however, to shrinkage in handling, the quart of milk when ready for sale will be the product of approximately 2.25 pounds. Therefore 2.25 is here used in reducing pounds to quarts.

Since the food cost per cow per year is one-half, and with high-producing cows more than one-half, of the total cost of keeping a cow, it can readily be seen from the above table that, although the price of milk to-day is higher to the farmer, it is not in proportion to the increase in the cost of feed, and consequently the farmer in 1912 had less income from his cows than he had in 1904.

Add to this the increased cost of cows, which in the same period probably amounted to 30 per cent., the increase in wages probably from 25 to 30 per cent., and the additional labor required due to more stringent regulations, and it can readily be seen that at the present time the farmer is producing milk below the cost of production even to a greater extent than in 1904.

This does not mean that the farmer has actually paid out more money at the end of the year than he has received for dairy products sold, but *it means he has accepted an interest less than 5 per cent. on his investment in buildings, equipment and cows; he has accepted low wages for his own labor and the labor of his family, and has marketed his crops fed to the cows at less than market prices.* These are the main factors which have made it possible for him to produce milk at such an apparent loss.

No manufactured article will for any length of time be sold below the cost of manufacture. The dairy farmer cannot continue to produce milk at a cost of 4.92 cents per quart and sell it for about 4 cents per quart. Unless the price is increased to the farmer the production of milk necessarily will decrease. A shortage of milk means a higher price for milk to the consumer. Beef and eggs have almost doubled in price in the last ten years, and the consumer is still buying both.

An increase in price of only 1 cent per quart to the farmer would encourage the dairy farmer to continue to produce milk, which at this time is of extreme importance to the future development of the dairy business. The 1-cent increase to the consumer which would necessarily follow would tend to prevent a threatening shortage of milk in Boston and prevent the price of milk soaring to the same relative high level as eggs and beef.

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SECOND EDITION.

CONTRIBUTION FROM THE DAIRY BUREAU, P. M. HARWOOD, *General Agent.*

WHAT IT COSTS TO PRODUCE MILK IN NEW ENGLAND.

BY P. M. HARWOOD.

WITH QUOTATIONS FROM SPECIAL ARTICLES BY MR. ELMER D. HOWE, PROF. JOHN M. TRUEMAN, PROF. FRED RASMUSSEN, AND BULLETIN BY DR. J. B. LINDSEY.

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WHAT IT COSTS TO PRODUCE MILK IN NEW ENGLAND.[1]

BY P. M. HARWOOD.

It costs around 5 cents and upward to produce a quart of market milk.

It costs 6 cents and upward, frequently 8 cents, to produce a quart of milk of superior quality and cleanliness.[2]

It costs 10 to 12 cents and upward to produce a quart of certified milk.

Market milk brought in by railroad cannot be sold at retail in large cities under the present system of handling, and return 5 cents to the producer and a fair profit to the dealer, for less than 10 cents per quart.

Milk of superior quality and cleanliness, usually a near-by product, cannot be profitably sold at retail for less than 10 to 12 cents per quart, according to the locality and conditions.

Certified milk cannot be retailed for less than 15 to 20 cents per quart and return cost to the producer with a fair margin for the distributor.

Retailing milk is a business by itself, whether done by the milk producer or by another.

The amount of certified milk sold in Massachusetts — the product of 10 to 12 dairies — is very small.

The amount of milk of superior quality and cleanliness, while considerably larger than that of certified milk, is small when compared with general market milk.

There were shipped into Boston by rail 114,433,976 quarts of milk in 1906 and 104,099,234 quarts in 1912, making a decrease of 10,334,742 quarts in six years. This, in the face

[1] The exact cost of milk production is not the same for any two dairymen; neither is it the same from time to time with any one dairyman. Variations in milk flow, available foods, accidental losses, hired help, and many other things enter into the computation. Therefore the cost of producing a quart of milk can be stated only in general terms.

[2] This includes so-called "inspected milk."

of an increasing population, indicates decreased consumption of fluid milk per capita, — poor economy.

There were assessed 181,818 milch cows in 1906 and 151,276 milch cows in 1913, making a decrease of 30,540 in seven years, indicating an unprofitable industry.

The permanent prosperity of a nation depends upon a prosperous agriculture; a prosperous agriculture in turn depends in large degree upon prosperous dairying.

Milk is a cheap food at 12 cents per quart. See Circular No. 1, "Food Value of Milk."

Until some other available animal product of equal nutritive value, ratio and digestibility, purchasable for the same or less money, is discovered, no consumer in a large city can justly complain of 10 cents per quart as a retail price for market milk.

The milk brought into Boston by railroad in 1912 returned to the producer 3.818[1] cents per quart. This milk cost the farmer who produced it approximately 5 cents per quart.

Inability to obtain cost price for milk is the principal cause of so many milk producers going out of business.

Consumers should be willing to help in the correction of this evil, especially as they will be the ones to suffer most in the end on account of a milk shortage. This can be done by using more milk; insisting upon clean milk and paying a fair price for it; taking proper care of milk in the home; and by co-operation in procuring just freight rates and economical distribution.

Milk should be sold on its merits both as regards milk solids and cleanliness.

The value of dairy inspection is often overestimated, — that of milk inspection never.

Penalization accomplishes little; education and encouragement much.

Clean milk can be obtained surely and permanently *only* when CLEANLINESS IS PAID FOR.

Raise the price of milk to the producer ONE CENT PER QUART, and the greatest single step in solving the problem will have been taken.

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[1] United States Department of Agriculture figures.

Elmer D. Howe, graduate and trustee of the Massachusetts Agricultural College, and practical dairyman of Marlborough, Massachusetts, says: —

Our experiment stations agree that the average cow in milk needs, for economical production, 25 pounds of hay or its equivalent in silage, roots, etc., plus 8 pounds of grain. This will make the food cost per day (with hay at $20 per ton and grain at $30 per ton), 37 cents per cow.

For 40 cows, food cost per day equals,	$14 80
A building for housing stock and hay will average to cost $100 per cow; interest on $4,000 at 5 per cent equals per day,	60
Depreciation of building at 5 per cent per year equals per day,	60
Depreciation of cows and loss in replacing equals per day (low estimate),	75
Taxes on building and cows (not on land) per day,	30
Milking 40 cows at 20 cents per hour equals per day,	1 60
Grooming 40 cows equals per day,	40
Cleaning stables and feeding per day,	60
Wear and tear of small tools, currycombs, brooms, etc., including service of bull, cost of city water, veterinary fees, ice, light, etc.,	15
	$19 80
Against this we have a credit of $2.50 per day for manure and 30 cents per day for calves born during the year (calves at $3 each at birth),	2 80
Net cost for 40 cows per day,	$17 00

For more than fifteen years we have weighed every cow's milk both morning and night and our records show that our cows (and we keep none that give less than 5,000 pounds per year) average just about 7 quarts per day. Forty cows, then, will average to produce 280 quarts of milk per day at an average daily cost of $17, or a trifle over 6 cents per quart.

By substituting 30 pounds of ensilage for 15 pounds of hay in the daily ration of each cow we are able to cut the cost to about 5 cents per quart, but the closest scrutiny will not reveal any other item where a saving can be made.

That Mr. Howe's figures are not too high is obvious when we consider that he has made no account of waste in handling, superintendence or profits beyond interest at 5 per cent.

Prof. John M. Trueman, formerly of the Connecticut Agricultural College, Storrs, Connecticut, now of the Agricultural College, Truro, Nova Scotia, in relation to the production of milk at the Connecticut Agricultural College says: —

Cost of Feeding. [1]

Silage, 4 tons at $4,	$16 00
Hay, $1\frac{1}{2}$ tons at $16,	24 00
Grain, $1\frac{1}{4}$ tons at $30,	37 50
Pasture, four months,	8 00
Total,	$85 50

In years when pasture is short, and grain and silage or green fodder must be fed all summer, the cost per year will frequently go up as high as $100.

The total cost of keeping each cow per year, therefore, is as follows: —

Feed,	$85 00
Bedding,	5 00
Keep of bull (for herd of 25 cows),	3 00
Taxes on cow and barn,	1 25
Interest on money invested in cows,	3 75
Barn rent,	3 00
Insurance,	40
Depreciation of cow,	13 00
Light, medicine, etc.,	2 00
Labor,	33 60
Total,	$150 00

The cows thus fed and cared for included Jerseys, Guernseys, Ayershires and Holsteins. Some were very good producers, others only fair. The average for the whole lot for the five years was 6,378 pounds per cow, which on the basis of $2\frac{1}{4}$ [2] pounds to the quart is equal to 2,834 quarts. Although this is not a heavy yield, it is a good average for a herd of 25 cows made up of several breeds. It requires extra skill and good management to increase the yield beyond this point. When it is remembered that the average yearly production for the New England States is less than 2,200 quarts per cow, it will seem that a herd making over 2,834 is doing fairly well. It is useless therefore, to hope to decrease the cost of milk by much further increase in the yearly production of the cows. Any material increase over 3,000 quarts in a large herd comes high from the necessary weeding out of ordinary producers and the small numbers of high producers to be found.

The cow should be credited with her calves and with the manure she makes. We cannot allow more than $5 per year for calves, nor more than $10 per year for manure in the barnyard. We can, therefore, credit the cow with $15 and subtract that amount from the $150

[1] These figures represent the average cost of five years, 1907–11, and are somewhat too low for 1913.

[2] The theoretical weight of a quart of milk is 2.15 pounds. Considering, however, waste which necessarily occurs in handling, 2.25 pounds more nearly represents what could be actually sold. Hence 2.25 is used in reducing pounds to quarts.

that it cost to keep her. This leaves $135 to be balanced by 2,834 quarts of milk, which would require the milk to be sold at the farmer's door for practically 4.75 cents per quart. This amount simply pays for the actual cost of the investment and labor put on the milk. It allows nothing for the farmer's skill as manager, nor for the extra hours he must work planning for the improvement of his herd and the running of the business, and nothing for profits. He has simply received 5 per cent on his investment and common laborer's wages.

If he is going to improve his farm and build up a permanent agriculture in an advancing rural community, and continue in business, he will require 5.75 cents or more per quart to pay the bill.

Fred Rasmussen, Professor of Dairying, New Hampshire Agricultural College, Durham, New Hampshire, says: —

The last census report shows the average production of milk per cow in Massachusetts to be 4,524 pounds, in New Hampshire 3,775 pounds, in Vermont 3,982 pounds. No doubt the actual production in the several States is higher than this. In the writer's opinion a more nearly correct estimate is between 5,000 pounds and 5,500 pounds of milk.

To get conditions which will represent average production for Massachusetts, New Hampshire and Vermont let us take the 39 cows, of the 26 herds [1] studied, producing between 5,500 and 6,000 pounds with an average production of 5,540 pounds of milk.

The Cost of Production.

Cost of feed, [2]		$66 91
Labor,		32 33
Delivery,		6 16
Housing,		9 05
Depreciation of cow,		8 83
Bedding,		4 00
Bull,		3 79
Taxes and interest,		4 55
Ice, coal and wood for heating,		2 17
Veterinary service, and medicine,		87
Tools, utensils, salt, etc.,		53
		$139 19
Credit: —		
Manure,	$15 00	
Calf,	3 00	
		18 00
Total,		$121 19

[1] See Circular No. 8 of this series; also Bulletin No. 2, New Hampshire College and Experiment Station.

[2] It costs less to feed these "average" cows than it does higher producers, which accounts for the difference in figures here given from those used in Circular No. 8.

Five thousand five hundred and forty pounds of milk equals 2,462 quarts, or, in other words, it costs $121.19 to produce 2,462 quarts of milk, or *4.92 cents per quart.*

At a selling price of milk ranging between 30 to 40 cents per can, or 3.7 to 4.7 cents a quart, the farmer, no doubt, is selling milk below the actual cost of production.

Comparison of Increase in Cost of Production with Increase in Price obtained by Farmer.

The following table shows the increase in the cost of the most common feeds, the increase in price of milk to the farmer and the increase in price to the consumer, 1904 and 1912.

Prices for hay have been obtained from reports of the Boston Chamber of Commerce. Prices for grain have been obtained from a table compiled by J. B. Lindsey, Massachusetts Agricultural Experiment Station. The price of milk per quart to the farmer is the price paid in the middle zone by one of the largest milk contractors in Boston. The price paid by the consumer is the price paid for milk delivered in glass for family use in Boston.

Article.	Hay, Grade No. 2, per Ton.	Linseed Meal per Ton.	Distillers' Grain per Ton.	Bran per Ton.	Gluten Feed per Ton.	Corn Meal per Ton.	Cottonseed Meal per Ton.	Milk.	
								Farmer's Price per Quart (Cents).	Consumer's Price per Quart (Cents).
Prices in 1904,	$13 00 to $16 50	$25 17	$24 31	$20 87	$24 24	$23 68	$26 52	3.24	7.5
Prices in 1912,	$21 50 to $28 00	$39 30	$39 94	$27 96	$31 51	$30 20	$31 20	3.90	9.0
Increase in per cent.	57.7 to 64.7	56.2	35.5	34.4	29.9	27.5	27.6	20.4	20.0

Since the food cost per cow per year is one-half, and with high-producing cows more than one-half of the total cost of keeping a cow, it can readily be seen from the above table that, although the price of milk to-day is higher to the farmer, it is not in proportion to the increase in the cost of feed, and consequently the farmer in 1912 had less income from his cows than he had in 1904.

Add to this the increased cost of cows which in the same period will amount to 30 per cent, the increase in wages from 25 to 30 per cent, and the additional labor required, due to more stringent regulations, and it can readily be seen that at the present time the farmer is producing milk below the cost of production, even to a greater extent than in 1904.

No manufactured article will, for any length of time, be sold below the cost of manufacture. *The dairy farmer cannot continue to produce milk at a cost of 4.92 cents per quart and sell it for about 4 cents per quart.* Unless the price is increased to the farmer, the production of milk will necessarily decrease. A shortage of milk means a higher price for milk to the consumer. Beef and eggs have almost doubled in price in the last ten years, and the consumer is still buying both. An increase in price of only 1 cent per quart to the farmer would encourage the dairy farmer to continue to produce milk which at this time is of extreme importance to the future development of the dairy business. The 1-cent increase to the consumer which would necessarily follow would tend to prevent a threatening shortage of milk in Boston and to prevent the price of milk soaring to the same relative height as eggs and beef.

Joseph B. Lindsey, Ph.D., Vice Director and Chemist of the Massachusetts Agricultural Experiment Station, in Bulletin No. 145, September, 1913, says: —

Cost of Milk Production (131 Cows, 1896-1911).

Average yearly food cost per cow,	$89.24
Net yearly fixed charges per cow (estimated),	$56.00
Total cost per cow,	$145.24
Average yearly yield per cow (pounds),	6,036.3
Average yearly yield per cow (quarts),	2,683
Cost of milk (100 pounds),	$2.41
Cost of milk (1 quart) (cents),	5.43

In making the above calculations a quart of milk has been held to weigh 2.25 pounds. The theoretical weight is 2.15 pounds, but the shrinkage in handling is sufficient to warrant the use of 2.25 as a practical conversion figure from pounds to quarts. The food cost of a quart is found to be 3.33 cents, and the cost for care and supplies (net fixed charges), 2.10 cents. The figures indicate that the farmer having a superior herd of Jersey grades, whose average milk yield is 6,000 pounds per cow, should receive substantially 5.5 cents per quart for it at the farm in order to get a fair market price for his roughage, and $35 per year for his labor, per cow, or $420 for 12 cows. If he had ordinary pasture for his herd this cost might be slightly reduced.[1] Profit other than the sale of roughage is not included, neither is allowance made for cost of supervision. Even if his herd consisted of grade Holsteins or Ayershires it is doubtful if he would find it profitable to sell his milk for less, unless the average yearly yield was considerably in excess of the above.

It is the belief of the writer that in the past a great deal of milk has been made and sold for less than the cost of production.

[1] The dry weather the last few summers has greatly reduced the value of the pasture.

Now that the health authorities are rightly demanding better dairy methods, the producer is indeed confronted with a serious problem, namely, how to conform to modern sanitary requirements in the face of the increased cost of labor, grain and tools and produce milk at a reasonable profit. He is meeting this problem at present in a negative way, by selling his cows and trying to turn his attention to other lines of agricultural industry.

Financing the Cow.

Few people have any idea what it costs to finance the cow. We know of no New England data upon the subject. The New York Experiment Station at Geneva has made a study of this question as applied to the milk supply of that city, and Bulletin No. 563 says: "Considered from the agricultural standpoint, the capitalization amounts to $763 per cow, of which the producer furnishes $680 and the retailer $83."

In other words, it costs the milk producers supplying milk to Geneva, New York, a city of about 13,000 inhabitants, $680 to finance each cow, and it costs the distributers $83 to finance the distribution of the milk of each cow.

The capital invested was estimated as follows: —

600 cows at $80,	$48,000
3,000 acres of land with buildings,	300,000
Equipment $20 per acre,	60,000
	$408,000
Capital invested in distribution,	50,000
Total,	$458,000

The Commonwealth of Massachusetts

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 10.

November, 1913.

CONTRIBUTION FROM THE DAIRY BUREAU, P. M. HARWOOD, *General Agent.*

PROTECTION OF MASSACHUSETTS DAIRIES FROM FLIES.

METHODS ADOPTED BY SUCCESSFUL CONTESTANTS FOR STATE BOARD OF AGRICULTURE PRIZES IN 1913.

BY P. M. HARWOOD, IN CHARGE OF CONTEST.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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1913.

Approved by
The State Board of Publication.

PROTECTION FROM FLIES.

BY P. M. HARWOOD.

For the information of practical dairymen and the benefit of the general public this circular, containing extracts relating to the prize winners, together with the final scores in the protection from flies contest of 1913 from the report of Mr. E. H. Forbush, judge, is published.

The following score card was used: —

	Points.
1. Means adopted to prevent fly breeding, including the treatment and disposal of manure, refuse, etc.,	25
2. Thoroughness of screening, shading, etc.,	15
3. Best methods of trapping, spraying, etc.,	10
4. General effectiveness of the whole scheme,	50
Total,	100

This method of scoring, placing special emphasis upon the prevention of fly breeding, was adopted because it was believed that such prevention is of primary importance. If no flies are bred there are none to screen or trap, and much annoyance and expense is avoided.

Extract from Mr. Forbush's Report.

The first prize, of $100, is awarded to Miss Helen Holmes, Kingston, Mass., on a score of 95 points. The methods of fly prevention adopted by her are as follows: —

Her stable is a modern one, with cement floors and gutters. It is washed down with a hose in summer and swept out and sprinkled with ground plaster in winter. The cement troughs in which the feeding is done are flushed out after each feeding. The walls and ceilings are painted twice each year with cold water paint. The manure is removed twice daily and placed in a pit. The horse manure particularly is treated daily with acid phosphate and kainite in equal parts, approximately two pounds per horse, to prevent fly breeding. In the cow stable cheese-cloth screens are placed in the windows on the north side. On the south side there are shutters left open at the top to allow the flies to escape. There are green cambric shades in the horse stable, so arranged that they flap outward to allow flies to escape. Miss Holmes says that her horses are never disturbed by flies in the stable. " Humane Fly Killer " and fly poison are sprinkled on floors and used in dishes in the windows. Fly papers are put up in the milk room. Home-made fly traps of the Hodge pattern are used in the barn. Cream cheese and molasses have proved to be the best baits in the traps. Cows are sprayed before being turned out to pasture and when they come into the barn at night. Only four flies were found in the milk room, which was open at the time it was inspected. The cow stable was very neat and contained but ten flies. Garbage cans about the premises were kept closed and treated with lime when washed. The privy contained vault tightly closed.

The second prize, of $90, is awarded to Mr. C. Herbert Poore, Bradford, on a score of 93 points. His is a modern stable, and both stable and milk room are carefully screened. There is a shed for the manure where wagon or manure spreader is kept, and the manure is hauled out and spread twice daily. A heavy curtain hangs in front of the manure shed to darken it, and a large fly trap is placed on top of the shed, so that the flies which come in quickly seek the opening above and go into the trap. This method and the frequent carting out of manure is intended to prevent the breeding of flies. Everything is properly whitewashed, and many sheets of fly paper are used in the milk room. Milk is bottled by machine and nine flies only were seen in the milk room and in the ice box, where it was so cold they were practically quiescent and harmless. The wash room was not darkened. There was no privy, there being a water-closet in the house.

The third prize, of $80, is awarded to Mr. L. W. Newton, Southborough, on a score of 91 points. His stable is a lean-to to the barn, with cement floors and well whitewashed. Horses are kept near by, but with a closed door between the horse stable and the cow stable. The cows are sprayed with " Cow Ease." The fly killer is used to kill flies daily. All windows are perfectly screened, and the stable is tight enough to exclude flies. Fewer flies were seen in this stable than in any other. The manure is thrown into the barn cellar and horse manure is covered with cow manure. The cows are brushed off daily as they come through the door. Twenty sheets of fly paper are laid in the windows. Only three flies were found in the milk room. The stable is small and but few cows are kept, but all are exceedingly well cared for. Water-closet in the house.

The fourth prize, of $70, is awarded to Mr. Henry Ferguson, Westborough, on a score of 88 points. His is an old wooden barn with a large cellar. Manure is thrown into the cellar, which is dark and cool. The stable is whitewashed and well screened. There are small cellar windows around the cellar, but those directly over the manure are screened, and flies did not seem to come in through the others. There were few flies in the stable and none at all in the milk room, which was screened and somewhat shaded. Two visits were made to this place and no flies were seen in the milk room although there were flies outside. The cows were sprayed daily with a disinfectant manufactured locally. The same disinfectant was sprinkled around the floor of the milk room and may have driven the flies out. The stable and milk room were screened. Chloride of lime and ashes were used in the privy.

The fifth prize, of $60, is awarded to Mr. Agostino Visocchi, North Sudbury, on a score of 80 points. Here was found a good, clean, well-constructed stable, with cement floors built on plans of his own. Leather strings were attached to the top of the door frame for the purpose of brushing the flies off the cows' backs as they entered the stable. There were but few flies in the stable. The windows were fully screened everywhere. Twenty-three fly papers, twenty-eight small fly traps and ten large ones were distributed about the stable. He keeps forty-three cows. The milk room was well screened and clean and also well supplied with fly traps. There were less than a dozen flies in the milk room. The horses are kept in a separate stable. The manure is not treated, but a pit is being made to receive it. No one had taken more pains to exclude flies than this Italian farmer, but he has not yet prevented fly breeding.

The sixth prize, of $50, is awarded to Mr. Jose Pontes, Swansea, on the score of 76 points. He has a wooden barn or cattle stable, which was found well cleaned, and sprayed with lime and salt frequently. The cows are sprayed daily with cattle oil. Manure is stored in the barn cellar altogether. No signs of fly breeding. The heap was frequently sprayed with lime[1] and salt and covered with a mixture of cotton and wool waste from neighboring mills. Spray was made by taking lime and water and putting in a considerable quantity of salt, which was used with a spraying machine as whitewash. No fly traps were used. The milk room was screened. There were but few flies in the stable and none in the milk room.

The scores of the other contestants were 69, 66, 62, 60, 54, 52, 49, 36, 25 and 15.

It appears from the above report that fly breeding may be to a considerable extent prevented by properly caring for horse manure and the contents of privies,[2] in which a large per

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[1] Lime is not advocated in this connection because, in contact with manure, it liberates ammonia, thus causing economic loss.

[2] Privy vaults should be tight and fly proof.

cent of the flies appearing about farm buildings are bred, by either hauling away each day or applying daily a mixture of acid phosphate and kainite, or covering with dry earth, and also by thoroughly caring for whatever garbage and other advantageous places for breeding there may be about the premises. A proper system of shading, that is, darkening rooms when not in use, as well as proper screening, go a long way towards keeping flies out of the stable and milk room. The judicious use of fly paper, traps, sprays, etc., aids materially in reducing the number of flies after they have appeared. The greatest effort, however, should be made to prevent fly breeding, and this should be done by using such means as are effectual, and at the same time do not injure the fertilizing properties of the manure.

We believe there is yet much to be learned in regard to the means of preventing fly breeding, and it is hoped that this contest and others that may follow will be useful in developing still better methods and devices.

Nature has apparently provided flies as the natural accompaniment of certain more or less disagreeable and unsanitary conditions. Remove these conditions and the necessity for flies no longer remains.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 11.

December, 1913.

CONTRIBUTION FROM THE DAIRY BUREAU, P. M. HARWOOD, *General Agent*.

SOME BACTERIOLOGICAL ASPECTS OF CLEAN MILK INSPECTION.

BY CHARLES E. MARSHALL, PH.D., PROFESSOR OF MICROBIOLOGY AND DIRECTOR OF THE GRADUATE SCHOOL, MASSACHUSETTS AGRICULTURAL COLLEGE, AMHERST, MASS.

BOSTON
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SOME BACTERIOLOGICAL ASPECTS OF MILK INSPECTION.[1]

BY CHARLES E. MARSHALL, PH.D.

Milk inspection assumes in the beginning that something may be wrong with milk. This seems patent when we reflect that the cow may cause the trouble; likewise the milker, the man who handles the milk, the consumer, the feed, the many utensils and manipulations through which milk passes, each may be responsible. So many possibilities; yet on the whole comparatively little mischief is done when we consider the very large amounts of milk used by the world at large.

This view, however, does not satisfy in any degree, because it is well known that human life is at stake. Were we to compare loss of life from milk with railroad accidents, industrial results, automobile carelessness and the many avenues through which lives flicker out through neglect, indifference and otherwise, encouragement ought to be forthcoming. This, however, is no excuse; it is the individual's task to serve mankind well and faithfully, whether some other feature of crowded humanity is attended to or not. It does seem, nevertheless, that milk is one of the willing horses for tired and critical wayfarers to ride because it is so free to burdens, for it is believed most of the troubles will yield to correction. If the subject were flies, doubtless far more responsible or guilty, there would be comparatively little to say, for nearly every one is somewhat guilty and responsible, and the remedies are not so carefully propagated.

To the responsibility of the milk producer nearly every ill associated with milk or in milk is traced. He is responsible to himself as to whether he is an educated man, a clean man, and a man trained in the efficiency of dairying. He is re-

[1] Lecture delivered before the Massachusetts Milk Inspectors' Association at Springfield, Mass., Dec. 2, 1913.

sponsible to himself whether he has cows which will respond to every test for soundness and the yielding of pure milk. If they are not sound, it is his responsibility to see that the lost capital is restored or go out of business. He is responsible for suitable ventilation and lighting of the stables; for the elimination of all dirt or contaminating material from the milk, whether it comes from outside or inside of the udder; for any diseases which may be traceable to his milk supply; for his water supply; for the utensils and refrigerators of his consumers; and last, if not least, for many ailments arising among his patrons, whether they drink the milk or not. He is held responsible to the laws and regulations of State and municipality, and subjected many times to humiliating inspection and direction. All of this, too, in the face of the fact that practically only a cow giving 6,000 to 7,000 pounds of milk each year will pay for her food and care, and the average in the State is scarcely above a cow giving less than 4,000 to 5,000 pounds of milk each year. In other words, the public is exacting a "6,000 to 7,000-pound-cow" business — just a cost business — out of a "4,000 to 5,000-pound-cow" business. Is there any other business which will stand such treatment?

This is a case of fortunate medical development over unfortunate agricultural development; city wealth and business methods over rural wealth and business methods; municipal power over rural power; city community knowledge over rural knowledge. Had some attention been given to these agricultural problems years ago, the agricultural phases could have kept pace, but there was no chance, and the sudden demands upon agriculture are overwhelming. Accordingly, we are all suffering from the sins committed. Now it is necessary to do the best we can.

It is only too true that vigilance must be practiced in the production of milk, inspections made of milk and dairies, and lives preserved from the dangers of milk. This should be freely granted and every duty faithfully executed, yet every detail should be carried out in the full light of the circumstances just revealed and in sympathy with the situation by men of suitable training, intelligence, appreciation and understanding.

You are inspectors, and I do not hesitate to speak plainly, for I believe you will confirm every word thus far uttered.

Now let us regard the details.

Here is the milk producer, who may be a man of character, intelligence, natural cleanliness and health; he may be a man unscrupulous, ignorant and prejudiced, naturally filthy and indifferent to disease. Two extreme types with all grades between are these, yet they are just what you meet. The milk producer is the key to the situation, for he really possesses the power of making or unmaking a dairy regardless of inspectors, cows, milk utensils, manipulation or handling. Here, too, begins the bacteriology of the dairy, for in him is to be found inexpensive intelligent direction or expensive ignorant direction. Upon him the inspectors must rely for their results and the city or town for pure milk.

Owing to this almost complete dependence upon the milk producer, and owing to the circumstances under which the milk industry exists at all, it should be evident that the attitude of the inspector must be that of helpfulness; of a specialist in dairy matters from A to Z; of an instructor and a silent, tactful adviser. Do not inspect, but tactfully instruct and advise.

The cow must be a sound animal to yield wholesome milk. Tuberculosis, with the light that is available, should be stamped out, for it is a menace to mankind and to the herds of the Commonwealth. Financially, it is for the interest of the owner of the herd to eradicate this disease, otherwise he will sooner or later pay the penalty in complete financial loss; hygienically, it threatens especially the infants of the land. Every sound business or sanitary reason points to this elimination, but of course immediate difficulties retard progress. When every intelligent owner of cattle is practically in readiness, the way is blocked by professional and other difficulties, lest horse and buggy be used in traveling the path instead of an automobile. My experience has been that it is not so much the desire of milk producers to prevent the use of the tuberculin test as it is the inclination to avoid the cost of professional testing, together with the possible loss from the disease. When State aid is invoked, similar loading up confronts the owners of cattle. Since the tuberculin test is acknowledged as the real diagnostic, can it not be put to advantage in a reasonable manner, and the eradication proceed in a slow but persistent movement? It has been done in some localities of wide extent, and I believe can be accomplished in a Commonwealth where the inhabitants are very conservative and yet highly progressive. I cannot enter into any detail, for this subject is sufficient unto itself.

Mastitis is a much reported disease in these days because of sore throats, scarlet fever and other unpleasant epidemics. Of course, it should be recognized at once that there are different forms of mastitis. Were it due to an inflamed and ulcerated udder there is doubtless need of attention, but any one who has passed an apprenticeship in milking realizes that in a herd of eight or ten cows it is seldom some garget does not appear in the mixed milk. Usually this is the result of some local or general inflammation. Tests are now offered for the detection of such difficulties. These tests are based on the number of leucocytes or kind of leucocytes, the character of the bacteria, upon the massing appearance or the formation of some form of ferment. All or any one of these laboratory tests should be used only as helpful diagnostics, to be interpreted in the light of actual findings in the stable. They may be used as indicators, confirmers, and, in conjunction with other tests and actual findings, become extremely useful in reaching conclusions.

It is unnecessary to speak further of the diseases of the animal, — as to the possibility of anthrax, or the more remote possibility at present of Malta fever, septic infections, cow pox, milk sickness, foot and mouth disease and others. The inspector should aim to know a cow as a breeder, the product of his efforts, intimately, not as it is usually understood, but intuitively. Training, skill, knowledge transformed into intuition will accomplish much in recognizing the ailments of milch animals. The true milk producer will possess this insight in a greater degree because of his acquaintance with the individual animals, — their habits, their normal condition and their abnormal moments.

In the milking of a cow is found largely the purity of the milk. Whether clean or not depends upon the man who milks and the cow which is milked. Even from a dirty cow clean milk can be drawn, but clean milk cannot be drawn from a clean cow by a man dirty by nature. Evidently the process is therefore dependent upon the knowledge of cleanliness in the milker and his skill to apply that knowledge. For instance, there has been drawn from a cow whose flank was covered with one-half inch of manure, milk that did not change at room temperature in twenty-eight days, but by the ordinary milker the milk drawn was curdled in thirty-six hours. This illustrates an extreme case of knowing how to proceed. Consequently, it is more necessary to have dirt adherent by means of moisture than to try to get rid of it completely, for do the best you can by grooming, a dry surface will always furnish scales. Cleanliness is most desirable, for it reduces the amount of chance, but a few acts of well-directed effort will be worth more than excessive expense instituted by uniform regulations. These must emanate from the knowledge and skill of man. Laws and regulations are designed for ignorance, lack of skill or maliciousness, and should not extend to the point where they interfere with well-directed effort and skill. Grooming, clipping and other precautions are admirable, but the man is more essential, not especially for decoration in white suits but with a clean, intelligent brain.

I cannot pass this without referring to the counting of bacteria. This is perhaps one of the most valuable means of test control available, but like all others should be subject to proper interpretation. Let us illustrate by citing an udder from which 50,000 bacteria per cubic centimeter were counted. The udder appeared normal and was normal so far as human agency could determine. This is unusual, but is incident to the dairy business. Familiarity with these things causes one to hesitate before pronouncing unless he has grown dogmatic by the process of using averages, as is so common. Again, suppose the milk producer furnishes a dirty milk and has been keen to keep down the bacterial count by ice. Such a man can outdo his clean neighbor who does not think ice so essential. Thus it is that a great many features may enter the count to vitiate its significance or value. When used properly, when safeguarded and when properly interpreted it provides a most valuable test for milk. It should not be employed arbitrarily but as an indicator.

The cooling of milk and the maintenance of a low temperature need no comment. It is desirable for clean and dirty milk and will stop germ multiplication in each. The colder, even to 32° F., the better, but there is a practical difficulty. Every milk producer cannot have ice at the present time; accordingly, 50° F. is usually too low for cold well water which can be provided for cooling. It means much, therefore, to maintain milk at 50° F. when the well water constantly freshly pumped registers only 52° F. I therefore take issue with a measure which will work a hardship when the difference to a clean milk producer is insignificant.

The milk producer has so much to bear that I suppose it is only adding insult to injury when all the faults of the consumer are placed on his shoulders. Only a milkman can tell you the many experiences which he has with customers. He cannot say anything. So far as I have been able to gather facts at first hand, the consumers are as derelict in caring for milk as the producer, and are more concerned about the extra penny put into pure milk production than pure milk itself. In a certain town there were two milk distributors as well as producers. They were extreme types, thus making a good illustration. The one was a leading citizen and a very painstaking man; the other was a dirty, indifferent man, almost a vagabond. Practically all the people in a village of about 1,000 inhabitants had, as consumers, at one price, the same clean milk; a difference of 1 cent, brought about by the untidy man lowering his price, turned the tide; 2 cents acted so completely that the clean man went out of business in disgust, simply because to sell at a lower price would mean financial loss. The consumer has a part to play, for milk is a necessity and milk producers are going out of business rather than contend under adverse conditions.

All of the microbiological devices for control point, it is true, to great exactions which milk producers may conform to some day, but we must remember that they must come through a process of evolution fostered by a sympathetic public. They must be linked with a progressive, persistent, intelligent helpfulness on the part of milk inspectors, who should be called dairy instructors and be real instructors as well.

The Commonwealth of Massachusetts

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January, 1914.

APPLE DISEASES.

By GEORGE E. STONE, Ph.D., Amherst, Mass.,
Botanist, Massachusetts State Board of Agriculture.

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APPLE DISEASES.

BY DR. GEO. E. STONE.

The unusual interest now being shown in the renovating and planting of orchards has stimulated a desire on the part of the orchardist to know something of the different diseases affecting trees. For a long time before this the apple industry had been on the decline, and thousands of neglected apple trees could be found in the State bearing inferior fruit and affected with innumerable troubles foreign to well-cared-for orchards.

For years we have been observing different orchards, with particular reference to diseases and the results obtained from the systematic use of lime and sulphur and arsenate of lead. With the advent of the new interest in orcharding, and the consequent renovation of old trees and extensive pruning, spraying, cultivating and fertilizing, diseases have become much less prevalent.

A few years ago it was the practice to spray apple trees six or seven times a season, without much regard to whether it was necessary or not; but pruning and cultivation, etc., are fully as important as spraying, which should be done only with some definite object in mind. It is true that progress in the successful management of orchards has often been hindered by a too liberal practice of spraying at the sacrifice of other methods, and to-day many growers are obtaining good results with only two or three sprayings.

The experience and skill of intensive farmers have been of great aid in determining the cause of and methods for controlling certain diseases, and it has been demonstrated that many factors other than spraying help to produce healthy crops. There are a number of fungous diseases occurring on the apple, some of which are parasitic; others follow mechanical injuries, and still others come about from various causes. The number of diseases affecting our cultivated crops is constantly increasing, most of them being introduced from other regions through commercial activities. Some apple diseases have been with us for many years, but just how long it is hard to learn in many cases, although some of the early works on fungi do not refer to them. The early agricultural and horticultural references are also very meager, and the identity of the disease is often left in doubt.

Some of the diseases affecting the apple in Massachusetts are given below.

Rots.

There are a number of fungi causing apple rots, and those found on the apple in this State are given below. In some sections of the country these rots cause an enormous amount of damage during the summer months, especially in warm, sultry, rainy weather. They are not serious here, usually being found on apples lying on the ground which have been bruised or are in an over-ripe condition, and also on those under poor storage conditions.

Bitter Rot (Glomorella rufomaculans (Berk.) Spandl. and von Sch.).

This rot (Fig. 1) has been known in this region for many years, and almost invariably attacks the apple on the ground or in storage, although some early varieties are occasionally affected to a slight extent on the tree, especially during warm, muggy weather. It is more serious in the west and south, where it causes an enormous amount of injury to apples.

The disease is characterized by dark-colored areas on the surface of the apple, which later contain minute, dark-colored pustules. These pustules contain smaller and more slender and light-colored spores than those of the *Sphæropsis* rot, described below. This as a rule constitutes only about 5 or 10 per cent of the apple rots in this section, although in

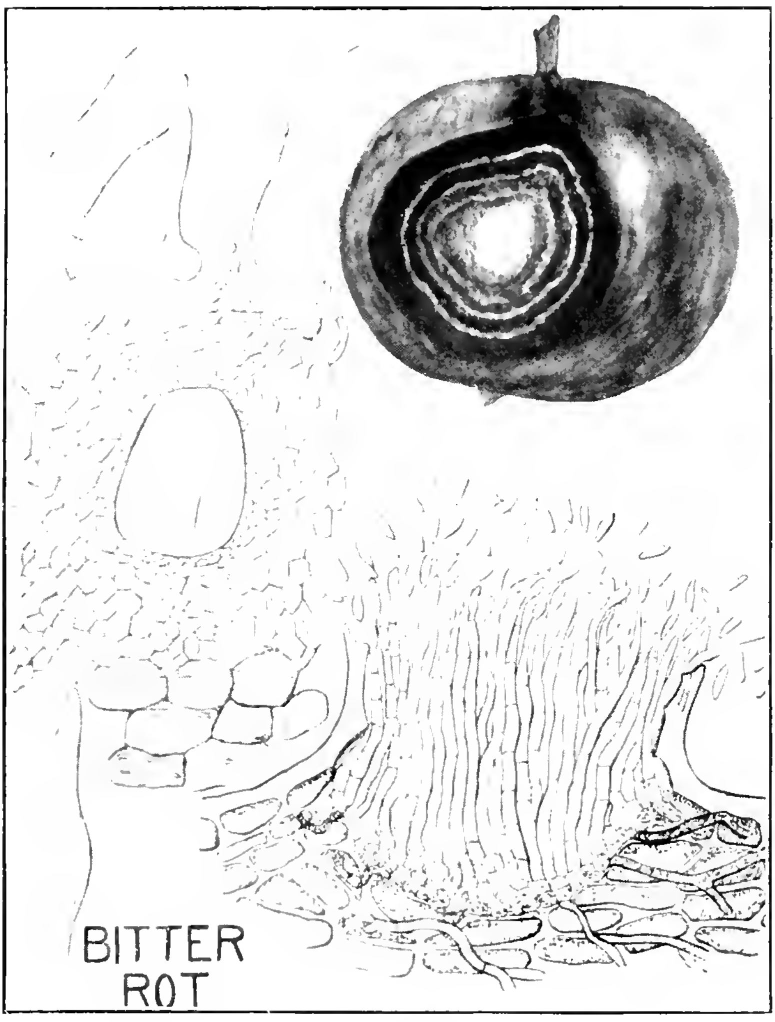

FIG. 1.— Bitter rot of apple.

1912 it was the most common of all. As already stated, it is much more serious in warm sections, and its unusual prevalence on fruit lying on the ground or in storage the past season was apparently due to the fact that the season was so warm.

According to our experience this rot hardly deserves treatment by spraying, since it makes its appearance so late and is confined to fruit that has been picked. Care should be taken to avoid all bruising in picking, and to secure the best possible storage conditions.

Black Rot (Sphæropsis Malorum Pk.).

This is usually the most common rot of apples in storage and on the ground, and we have never seen it attacking fruit on the tree in this State. It is quite similar to the preceding in appearance. The principal naked-eye characteristic distinguishing it from other rots is the absence of concentric growth of the fruiting bodies. The spores are borne in little pustules, resembling those of the bitter rot, but are larger and darker colored.

Sphæropsis is associated with one of our common cankers, and in all probability is responsible for most of our apple leaf spots. As an economic factor this rot is of little importance in this State and does not warrant spraying treatment.

Fruit Mold or Brown Rot (Sclerotinia fructigena (Pers.) Schroet.).

This fungus is responsible for the brown rot of the peach and plum, and also occurs on apples, especially on those which are over-ripe, affected by frost, etc. The light-colored fruiting bodies of the fungus may be seen on the surface, and resemble a mold. This rot is of no economic importance in this State.

Fruit Mold (Penicillium sp.).

Some apple rots are associated with our common green mold, *Penicillium,* and other organisms, such as yeast, are sometimes present, which give a characteristic ferment odor.

This organism, however, must be considered as being purely an accompaniment of apple rot and not a specific cause of the trouble.

Core Rot.

Apples are sometimes found affected with what is termed core rot, an internal rot confined to the core. This disease has been observed in New York by Stewart, who describes the injured tissue as brown, dry and tasteless. No organism has been found associated with this trouble. Occasionally where worm holes occur there is more or less interior rotting of the fruit, but in the case of core rot there is no evidence of any communication between the exterior and interior of the fruit from the work of insects, etc. Only a few cases of this have been observed about here.

Cankers.

There are a few fungi which cause a more or less common trouble to apple trees, termed cankers. Some of them are caused by organisms which affect apple trees in other ways; for example, *Sphæropsis* is caused by an apple rot as well as canker. The fire-blight organism produces canker, and in some sections a canker is produced by a bitter rot fungus (*Glomorella*). All of these cankers are more common on neglected trees.

Canker (*Sphæropsis Malorum Pk.*).

This fungus (Figs. 2 and 3) is associated with one of our common cankers, and is most frequently found on the smaller branches. It is characterized by dead areas on the bark, causing more or less irregular scars. On rapidly growing trees this canker sometimes causes a restricted growth and bending of the branches. Some phases of the canker resemble sun scald, and from our observations it appears to follow such injury. Treatment with lime and sulphur during the dormant period is undoubtedly as effective as any which can be recommended.

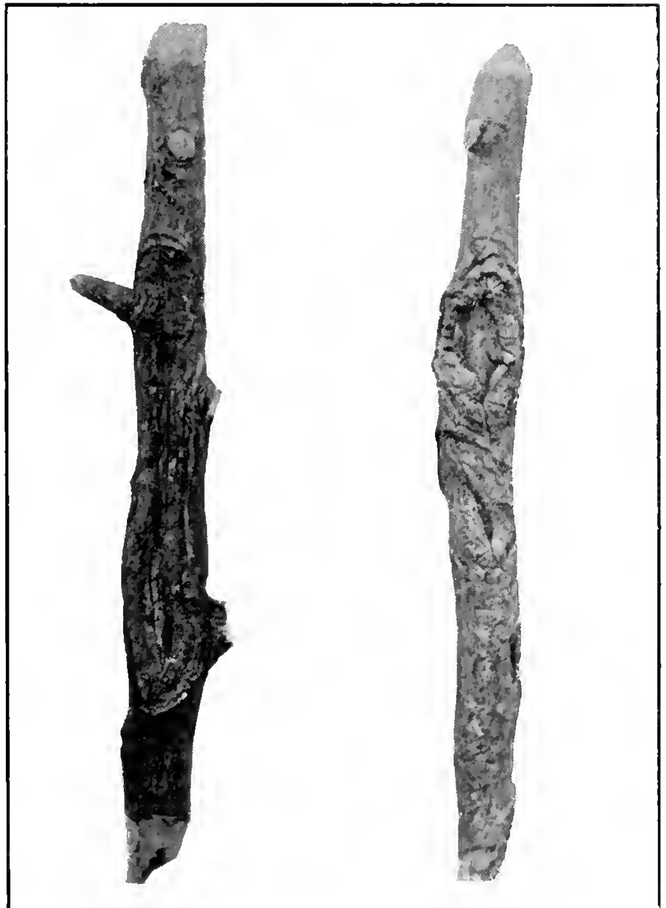

FIG. 2. — Showing *Sphæropsis* canker on apple twigs.

FIG. 3. — Showing irregular and twisted growth on apple branch due to canker (*Sphæropsis*).

European Apple Canker (Nectria ditissima Tul.).

This canker (Fig. 4) is usually characterized by ugly scars, due to the distortion of the tissue by the fungus named above. It is less common than the preceding canker, except on neglected trees, where it sometimes does much injury. Our earliest New England literature refers to canker on apple trees, and it is not unlikely that this is the one meant. In most cases it seems to follow injuries from various causes. Where the disease is severe it should be pruned out.

Nectria Canker (Nectria cinnabarina (Tode) Fr.).

This fungus (Fig. 5) is responsible for a canker which is characterized by the production of numerous cinnamon-colored pustules on the bark of dead wood. It is occasionally seen on apple trees, but more commonly on winterkilled branches of maples, horse chestnuts, etc. So far as our observations go, this is invariably a dead wood fungus following injuries of different types. The fungus penetrates the bark and wood and gives rise to discolored areas of the woody tissue.

Blight Canker.

A canker of rare occurrence with us has been described by Dr. H. H. Whetzel (Fig. 6). It is caused by the apple and pear blight organism, and occurs most frequently on young, smooth bark trees and on water sprouts. The diseased areas are smooth, sunken and brown in color, and there is no formation of pustules. The freshly affected tissues are usually watery, and in older cases cracking of the bark occurs. More often infection is confined to the bark, causing no injury to the wood. It is believed that only a small percentage of this canker lives through the winter to serve as a source of infection the following year, and that insects play some part in the work of infection. Another source of infection is the pruning knife.

Blister Canker (Nummularia discreta Tul.)

A form of canker caused by the above-named fungus has been observed in apple-growing regions of the Mississippi valley, but never in our section. This canker is characterized by a black, rough, more or less charred appearance of the bark on the older parts of the tree. On the surface of the diseased areas may be seen circular dots or fruiting bodies which are regarded as the most characteristic feature of the disease. We have recently seen a few apple trees in this section which seem to show the symptoms of this canker, but the specific fungus was not observed. It is believed to be a wound fungus.

Apple Rust (Gymnosporangium macropus Lk.).

This species of fungus is believed to be the principal cause of the apple rust in our section, one of the stages being found on the pear and quince. It is also believed to produce the so-called cedar apple on our common pasture juniper (*Juniperus virginiana*). Its appearance during the past few years has seemed to coincide with a general epidemic of rust throughout the country, and although it had been unusually rare on apples for many years in Massachusetts up to the past three or four years, since then it has often been found on foliage, and sometimes on the fruit. It is more common on neglected trees than in a scientifically managed orchard.

All rusts are difficult to control by spraying, but besides the general treatment which apple trees should receive each year, sanitary methods of culture should be practiced.

Apple Scab (Venturia Pomi (Fr.) Wint.).

A disease known as apple scab has been present in Massachusetts for many years, affecting both the leaves and fruit and occasionally the twigs of several varieties of apple trees, — in this State, more particularly the light-colored varieties. Fortunately, the disease seldom assumes a severe form here. It is more commonly found on the foliage than on the fruit, especially in unsprayed, neglected orchards. It is character-

FIG. 4. — Showing European canker (*Nectria ditissima*).

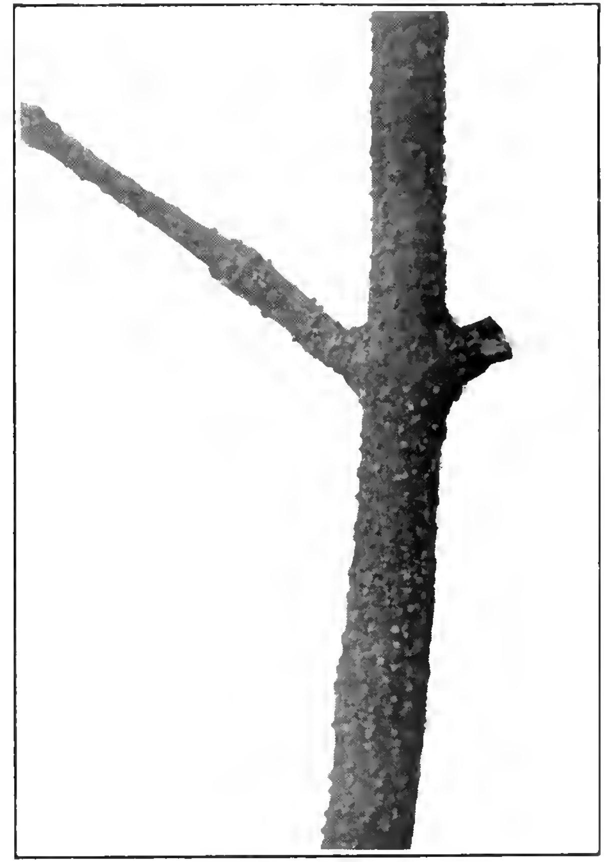

FIG. 5. — Showing canker (*Nectria cinnabarina*) on dead twigs.

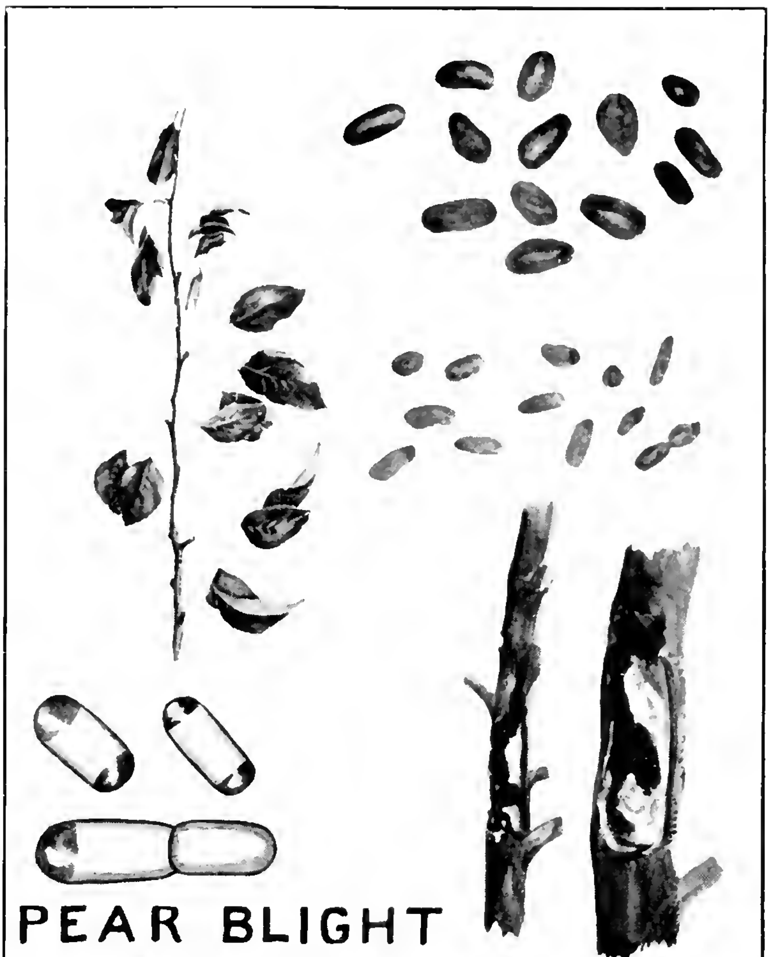

FIG. 6. — Pear blight canker.

ized on both the leaves and fruit by dark-colored or olivaceous spots, giving, as the name indicates, a scabby appearance to the fruit and leaves.

Treatment with lime and sulphur in the spring, in the dormant period, according to our observations, holds the fungus in check. Other fungicides also control it.

Pink Mold or Pink Rot (Cephalothecium roseum Cda.).

Since 1902 a pink mold has been known to be associated with apple scab, although it has caused little or no trouble in this region. As the name implies, it is of a pinkish color and is confined to the scabby spots on the fruit, developing over the surface of the scab. Although the fungus has been present for some time in this region on dead wood, etc., it was supposed to be perfectly harmless until 1902, when it was discovered as an accompaniment of the scab. It causes much more injury elsewhere than here, and is more severe in moist seasons.

Any treatment which will control the scab is applicable to this mold.

Leaf Blight (Sphæropsis Malorum Pk.).

It is generally believed at the present time, from the results of experiments, that the above-named fungus is the cause of the so-called leaf spots of the apple, although they were formerly attributed to other fungi, known as *Phyllosticta Pyrina* Sacc. and *P. limitata* Pk. These two species of *Phyllosticta* are now considered merely accompaniments of the leaf spot, occurring only in the later stages of the disease. The foliage of most neglected apple trees develops these spots, and the disease is sometimes severe enough to affect the growth of the tree. The fungi associated with the leaf spots, however, are easily controlled by spraying with lime and sulphur in the spring before the buds open, and therefore are of minor importance in well-cared-for orchards. Many orchards go through the season without a spot as a result of spraying with lime and sulphur in the dormant period of the tree.

Sooty Blotch or Fly Speck (Phyllachora pomigena (Schw.) Sacc.).

A fungous growth known as sooty blotch or fly speck has been common for many years, occurring on the surface of apples. With us it affects Greenings more commonly, sometimes discoloring the fruit to quite an extent. It was formerly believed that there were two species of fungi, — one causing the blotch, the other fly speck, — but it is now generally recognized that one species of fungus causes both. Both of these forms occur on the surface of the fruit and do not penetrate the cuticle, and they can easily be removed by washing.

Sooty blotch forms large, irregular, olive-brown areas on the fruit, while fly speck occurs as minute dark-colored dots scattered over the surface. The trouble appears to be more abundant in the shade and where there is considerable moisture. The fungus does not injure the fruit other than to affect its market value, and it can usually be controlled by spraying late in the season with Bordeaux mixture.

Apple Blight, Fire Blight, Twig Blight, etc. (Bacillus amylovorus (Burr.) DeToni.).

This blight has been common for many years on apples, pears and quinces, and is often severe in some parts of the United States. It is caused by a minute organism (bacillus), and it is generally recognized that infection takes place at the period of pollination. The blight is characterized by a blackening and shriveling of parts of the twigs or branches, and the leaves droop and turn brown, but do not fall. The organisms under certain conditions multiply very rapidly in the nectaries of the flower, and are readily transferred to other flowers by bees. From the nectaries the bacteria gain entrance to the tissues of the small branches, causing them to collapse. In most cases direct infection probably occurs by means of insects, abrasions, etc. The blight organism also occasionally causes what is termed blight canker. The blight is not so serious in our section on the apple as on the pear and quince.

The principal methods of control consist in pruning out the infected limbs, at least a few inches below the affected region. Fall and winter pruning is considered better than summer pruning, since the affected parts may be more readily found, whereas in summer the disease may be spreading rapidly and all of it may not be eradicated. In all cases of pruning, antiseptic methods should be employed, such as sterilizing with formalin or some other substance the tools used in pruning, or treating the cut surfaces with creosote, etc.

Powdery Mildew (Erysiphe Polygoni DC.).

This mildew is seldom found on apples in this section. It occurs on nursery stock in some regions, where it causes more or less injury in the form of a mildew effect on the upper surface of the leaf.

Crown Gall.

Crown gall (Fig. 7) has caused vexation and worry to many fruit growers for the past few years, although the amount of actual injury done is somewhat problematical. For a few years considerable infected apple stock came into our State from outside, but for the past four or five years orchardists have been more particular about their material, and cleaner stock has been obtainable. There are only a few instances where trees have been so severely affected as to die, but one never knows when complications may set in and result in loss.

There are many forms of galls affecting plants, but practically all have a similar distorting effect on the tissue, which may seriously interfere with the vital processes of the plant. Eel worm galls, which are similar in appearance to those found on the apple tree roots, cause little injury to tomatoes and cucumbers, but are very injurious to roses, violets and melons, and in the south, various other crops, including some trees, are affected.

There is much difference of opinion as to the effect of crown gall on apple trees, which appears to be more injurious in the warmer parts of the country. Nevertheless, no orchardist should accept material affected by this disease.

While the specific bacterial organism has been isolated, and many cross inoculations made, there is yet much to be learned concerning the relation of a particular type of gall to another. Extensive investigations made by Smith and Townsend seem to indicate that the organisms causing crown gall on the raspberry and apple are similar, yet our raspberry has had galls for years, while apple trees have been free from them until comparatively recently. Crown gall was not observed here until certain infected stock was obtained from outside the State. Where infected stock has been planted and cultivated, the disease spreads from one field to another, and seedlings raised on soil which was formerly free from the organism become infected. It is possible that much of our infected stock already planted will pull through and develop into bearing trees; but it is a wise precaution to secure clean trees when planting.

Crown gall, as its name implies, is characterized by a gall formation near the crown, which causes a distortion of the tissue, and in very severe cases it interferes with the function of the plant to such an extent that death results.

Hairy root (Fig. 8), which is characterized by the abnormal production of roots, giving a hairy effect, appears to be a similar trouble, although it is much less common with us.

Baldwin Spot or Fruit Pit.

This spot, which has been known by several names, has been present in Massachusetts since 1898 at least, and has been confined, to our knowledge, to the Baldwin in this section. It is characterized by small spots or indentations on the surface of the fruit, ranging from 2 to 4 millimeters or more in diameter, which are scarcely perceptible to one not acquainted with the disease. The spots are usually so insignificant that expert judges of fruit have been known to place premiums at fruit shows on apples badly affected with this trouble. In cutting open an affected fruit, numerous

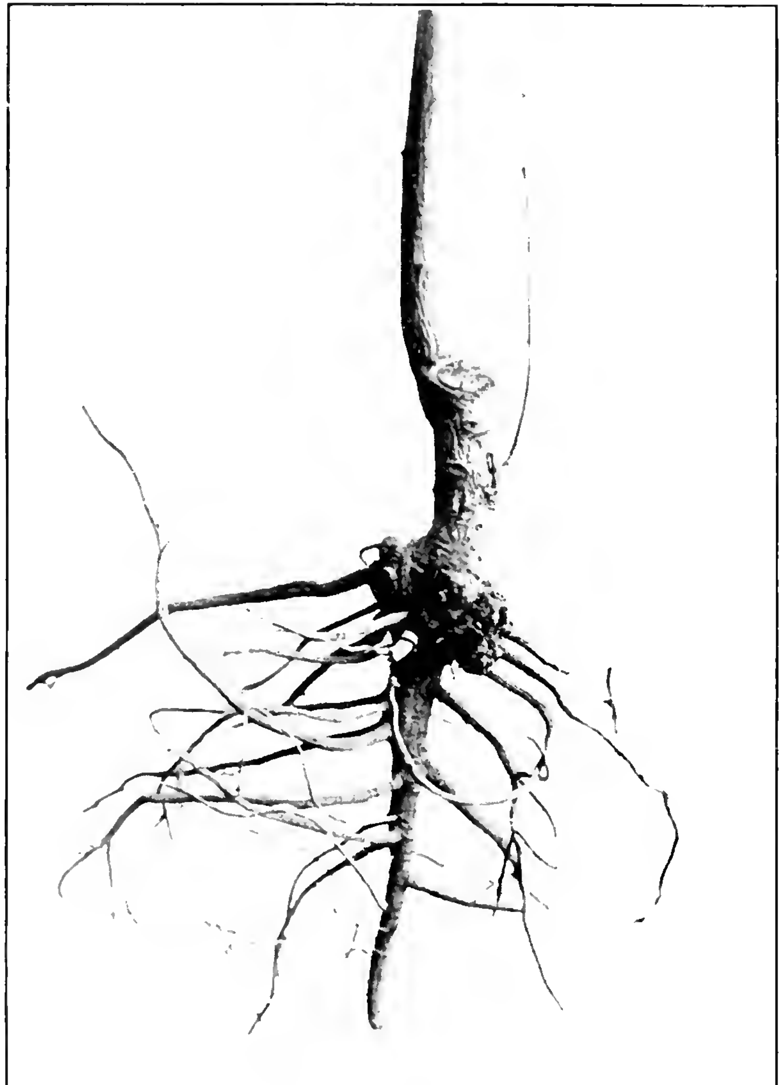

FIG. 7.—Crown gall of apple.

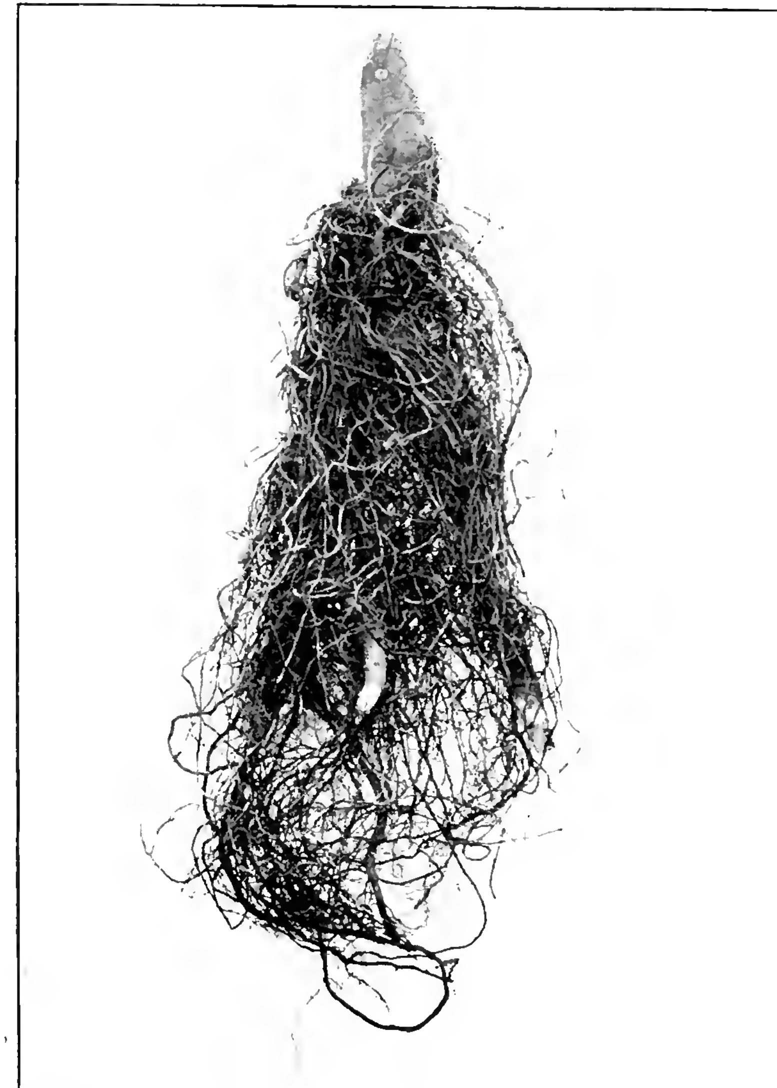

FIG. 8.—Hairy root.

brown areas may be seen extending quite deeply into the tissue, which give it a bitter taste.

The cause of this spot is not known. Some years ago we tried to associate it with meteorological conditions, and interviewed many fruit growers in regard to its appearance in different seasons, but we were unable to establish any definite relationship, although the spot seemed to be more common after extremely dry periods. The disease is apparently of a functional nature, since spraying has no effect on it.

Baldwin Fruit Spot (Cylindrosporium Pomi Brooks).

This disease (Fig. 9) is characterized by spots very similar in many ways to those caused by the Baldwin spot or fruit pit, and has only been observed on apples in this State for three or four years. Only recently an experienced fruit grower, in describing this spot before a number of orchard specialists, found none of his audience familiar with it.

The spots are larger and more distinct, and the indentation is usually lacking, so that as a rule there is little excuse for confusing it with the old Baldwin spot. It attacks several varieties of apples, differing in this respect from the Baldwin spot previously noted. This disease is caused by a fungus (*Cylindrosporium Pomi* Brooks) and is much more severe here than the Baldwin spot, but like this it extends below the surface and turns the tissue a reddish brown. According to Dr. Brooks of the New Hampshire station, who has given it much attention, it first appears about the middle of August. The spots develop about two weeks before harvesting, during periods of dampness. The fungus gains entrance to the fruit in July or early August, and is said to be controlled by spraying with Bordeaux mixture, applications being made in June or early in July. From the general appearance of this spot one might surmise that it was the old Baldwin spot attacked by a fungus which has modified its appearance somewhat, although it occurs, as has been said, on a much larger number of varieties.

An inspection for the last three years of some of the best orchards in the State has revealed only a few affected apples on each tree, although on individual trees in some orchards we have seen 50 per cent. of the apples diseased, and in many cases no spotting at all was seen. The trees which were so badly affected were old ones which had recently been cultivated and fertilized, and the manager attributed the outbreak to the application of nitrogenous fertilizers and the recent renovation of the orchard. Another successful orchard manager gave damp periods following drought as the cause. For five years we have been having severe droughts in the summer, followed by rains in the fall, and this spot has made its appearance during this period.

Winterkilling.

Winterkilling often occurs below the surface of the ground as well as above. During the cold winter of 1903–04 many apple trees were seriously injured, both above and below, in some States whole orchards being wiped out. Such injury is not always associated with cold weather, much depending on the condition of the tissue before the tree enters the winter.

The causes underlying winter injury are severe cold, when the frost penetrates to great depths; sudden and severe cold following prolonged warm periods in the fall; general low vitality, caused by lack of food; insect or fungous attacks; lack of moisture and organic matter in the soil; lack of snow covering; location in exposed situations, etc. Any condition which favors a soft growth and immaturity of the wood, whether from too much moisture or too heavy manuring and fertilizing, tends to produce winterkilling, as does also absence of sufficient sunlight. Trees growing where they receive the overflow from cesspools, etc., have been known to winterkill when others near by would not. Piling dirt three or four inches high around the base of young trees in winter often causes injury similar to winterkilling in nature, and tarred paper has the same effect.

Barnyard manure used as a mulching helps to prevent injury from winterkilling, and even sod is a great protection.

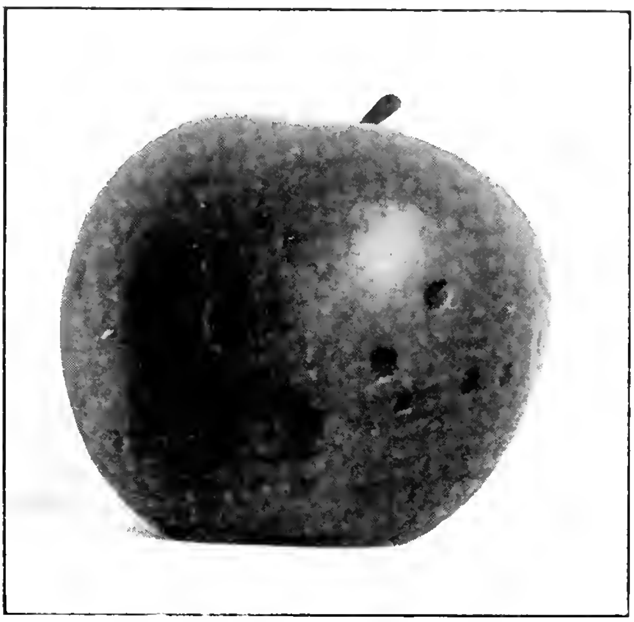

FIG. 9 —Showing Baldwin fruit spot (*Cylindrosporium*) on apple.

Frost Cracks.

Frost cracks are sometimes found disfiguring and injuring fruit trees by splitting the bark and wood of the limbs. In some cases they open only one-half inch or so, while in severe cases they may be three or four inches wide. They occur usually during sudden reductions in winter temperature. Extreme cold has a similar effect on the tissue to drying or shrinking, by causing a withdrawal of water from the cell walls, thus rupturing the tissue, and while the cracks sometimes heal over, they more often do not. They open wide in winter, and their opening and closing are affected by various meteorological conditions.

Frost cracks are very difficult to treat, but we have found that the best way to handle them is to paint the inner surfaces of the cracks with coal tar or paint in winter when they open up. Then in spring or summer, when the cracks close, staples of one-half or five-eighth inch iron, with prongs three or four inches long and pointed ends, may be driven into the trees after boring a hole with an auger. The staples should be painted and the bark cut away underneath, so that they may be driven in flush with the wood, when they will heal over and disappear.

Frost Blisters.

Occasionally during the past ten years we have observed a spotting on apple leaves caused by injury from spring frosts, and during the summer of 1902 considerable defoliation resulted, as much as 30 per cent. of the leaves falling from certain trees in July and August. The trouble was in general confined to the sections where the spring frost was most severe.

This frost injury occurs just as the leaves are unfolding, the frost rupturing the tender epidermal cells on the under side of the leaves. As the leaves develop, conspicuous, irregular spots may be found on the upper surface, corresponding in a general way to the ruptured areas on the under side of the leaves. The heavy loss of water from the leaves following this injury causes them to deteriorate and fall off in large quantities.

Treating Cavities.

No tree is so often found with cavities as the apple, and perhaps none will thrive with so much decay of the heartwood, etc., as this species. The principal cause of the decay is poor pruning and lack of antiseptic treatment of wounds. When long stubs are left after pruning, the decay works into the heartwood and a cavity results. These long stubs never heal over, since the healing surface is not in direct communication with the flow of plastic substances. Large wounds, if not painted, will decay even if the branches are cut close.

Apple trees will live and thrive for many years, even when the heartwood of the trunk is completely destroyed, since the sapwood appears to be immune to most of the organisms causing decay. Modern tree surgery methods, however, can be used to good advantage on apple trees. A cavity should first have a thorough cleaning, followed by treatment with creosote, and should then either be filled with cement, or the orifice of the cavity tinned over or covered with some other suitable material.

Effects of Drought.

It often happens that in a wet spring trees will produce more foliage than they can support throughout the summer, especially if a severe drought occurs, resulting in a premature loss of foliage. The ideal moisture conditions for fruit trees consist in having a plentiful supply of moisture during the growth and early ripening of the fruit, with a bright and relatively dry period, characteristic of Indian summer, for the maturity. If there is too little moisture in summer the fruit is likely to be small; on the other hand, a dry summer followed by heavy fall rains affects the quality of the fruit and the ripening of the tissue, and is conducive to winterkilling. As already noted, it may also have some effect on the occurrence of the Baldwin spot.

Sun Scald.

This is a common type of injury, especially to the apple, pear, peach and plum, and is more likely to affect nonripened wood. It is much more common on neglected apple trees, and a few years ago was quite prevalent in the State, particularly on the lower branches, which were secluded from the light. Sun scald is characterized by a sunken, blackened appearance of the bark. Anything which prevents the wood from ripening makes the tree more susceptible to this trouble, and canker often follows it.

A similar trouble is known as collar rot, to which certain varieties of apples are particularly susceptible. This attacks the base of the tree, and is characterized by the death and abnormal appearance of the outer bark.

Storage Burns.

A storage burn of the apple which causes discolored spots, and which is undoubtedly a climatic trouble, occurs occasionally. This was unusually common during the fall of 1912, and one large shipment of Massachusetts apples to Europe was ruined in transit by the burn.

There are undoubtedly a number of causes responsible for storage burns, such as lack of light, too much soil moisture, etc., when the fruit is ripening, also warm periods such as were common during the past fall and winter (1912–13).

Spraying Injury.

Most of the spray injuries in our region result from unfavorable climatic conditions preceding or during the time of spraying, although some are due to the unusual susceptibility of certain varieties, and others to improperly prepared spray material. Peach and plum trees, for example, are injured by customary strengths of the Bordeaux mixture, and we have seen plum trees defoliated by spraying with arsenate of lead. It is possible to cause injury with almost any insecticide or fungicide under certain conditions, and this is also true of fumigation. Many of our oil sprays have been known to injure apple and even shade trees when in the dormant condition, and judgment must be used in applying them. Even kerosene can sometimes be sprayed on certain plants without injury, although at other times it may kill the plant. Kerosene used directly or diluted with water is dangerous to many trees, as are various other oils.

Bordeaux mixture, even when properly prepared, causes burning to fruit trees under certain conditions (Fig. 10). In the south such injuries are more common than with us, but even here russeting of the fruit sometimes occurs from Bordeaux, as well as burning of the foliage. Meteorological conditions are responsible for some of the injury from spraying; for instance, spraying during cloudy periods, when the foliage and wood are not properly matured; and spraying mixtures left on the foliage in solution for a long or short period cause injury. Therefore, trees sprayed in the sunshine, when the solution quickly dries on the foliage, are less likely to burn. There are also many other factors which enter into burning of the foliage and russeting of the fruit, such as soil moisture.

Sunlight as a Factor in Apple Orchards.

No factor has a more important bearing on vegetation than sunlight. Through its action on foliage, plants obtain most of their food from the air, and tissue is rendered less susceptible to disease, since the physiological effect is to inhibit growth and render tissue more resistant. Aside from the necessity of pruning apple trees to make them low headed to facilitate picking the fruit, pruning is very important from the disease standpoint. Proper pruning and thinning give light a chance to reach all the branches, fruit and foliage, and thus modify the tissue and make it more resistant. Light is also important in preventing sun scald, winter-killing and other troubles.

A few years ago sun scald was quite common on neglected apple trees in our State. The most notable feature connected with the injury was the fact that it was confined to the shaded

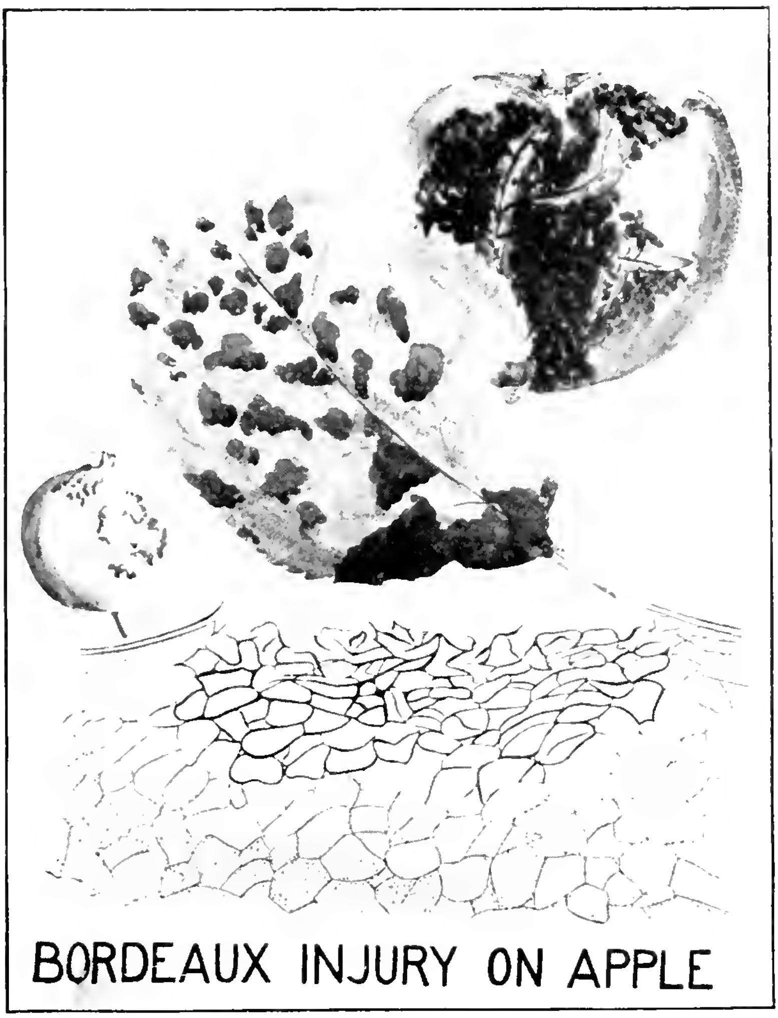

Fig. 10. — Bordeaux injury on apple.

limbs and branches where the light was more or less excluded, and was very rare on thinned trees. On the other hand, too intense light may cause injury to tender growths when shaded, as when young trees are suddenly stripped of their foliage by insects, or where too rapid growth results from severe pruning, followed by cultivation and fertilization. Sun scald is occasionally found on the larger limbs of trees which have been more or less shaded, and therefore receive too much light from severe pruning. A well-thinned tree is likely to be less affected by different diseases, and the danger from burning of various kinds is lessened.

Undoubtedly much of the spraying injury to fruit and foliage is associated with lack of light and other climatic factors, and the injury from fumigation has a relation to light intensity and moisture. There is much evidence to show that the practice of pruning apple trees is of much importance in controlling certain troubles.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 13.

January, 1914.

CONTRIBUTION FROM THE DAIRY BUREAU, P. M. HARWOOD, *General Agent.*

CLEAN MILK CONTEST.

1913.

BY P. M. HARWOOD, IN CHARGE OF CONTEST.

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2. "Insecticides, Fungicides, and Directions for their Use," by Dr. H. T. Fernald, 1913.
3. "Balanced Rations for Dairy Stock," by Dr. J. B. Lindsey, 1913.
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Approved by the State Board of Publication.

REPORT OF CLEAN MILK CONTEST, 1913.

BY P. M. HARWOOD.

Chapter 96 of the Acts and Resolves of the Massachusetts Legislature, 1913, entitled, "Resolve to provide for the encouragement of dairying and the production of milk and dairy products of superior quality," gave to the State Board of Agriculture the sum of $15,000, of which not over $5,000 could be expended in any one year. By vote of the Board, the carrying out of the provisions of this resolve was given to its Dairy Bureau. Accordingly, the Bureau took up the work and laid out a campaign along lines which, so far as we know, are practically new. The following was issued in the month of August: —

Notice to Massachusetts Dairymen.

The Commonwealth of Massachusetts has given into the hands of the State Board of Agriculture a sum not exceeding $5,000 annually for three years to be expended in the encouragement of practical dairying and the production of milk and dairy products of superior quality and cleanliness.

This sum is only one-fifth of the amount originally asked for, and on that account only a portion of the work originally intended can be done. This year a beginning is made by offering prizes sufficiently liberal to induce a spirited contest in cleanly methods, with a view of encouraging the habit of keeping dirt and flies out of milk and other dairy products.

A popular bulletin entitled, "Cost of a quart of milk," will be issued if funds permit. Next year other phases of the question may be taken up.

The State Board of Agriculture, through its Dairy Bureau, offers $2,550 in cash prizes for clean milk.

For convenience the State will be divided into two sections, viz., eastern and western. The eastern section comprises the counties of Essex, Middlesex, Suffolk, Norfolk, Bristol, Plymouth, Barnstable, Dukes and Nantucket; and the western section, the counties of Worcester, Franklin, Hampden, Hampshire and Berkshire.

Dairies located in the eastern section will be visited during the month of September, and those in the western section during the month of October, by duly authorized experts, and samples of hand-drawn, unstrained, mixed milk taken and tested for cleanliness.

The results of the tests in the eastern section may be shown in connection with the dairy exhibit of the Massachusetts Dairymen's Association to be held at the Brockton Fair, September 30 to October 3, inclusive. The results of the tests in the western section will be shown at the exhibition of the Massachusetts Dairymen's Association, to be held in connection with the public winter meeting of the State Board of Agriculture at Springfield, December 2, 3 and 4.

The prizes offered in each section are as follows: —

First prize,	$100 00	Eleventh prize,	$50 00
Second prize,	95 00	Twelfth prize,	45 00
Third prize,	90 00	Thirteenth prize,	40 00
Fourth prize,	85 00	Fourteenth prize,	35 00
Fifth prize,	80 00	Fifteenth prize,	30 00
Sixth prize,	75 00	Sixteenth prize,	25 00
Seventh prize,	70 00	Seventeenth prize,	20 00
Eighth prize,	65 00	Eighteenth prize,	15 00
Ninth prize,	60 00	Nineteenth prize,	10 00
Tenth prize,	55 00	Twentieth prize,	5 00

There will also be awarded sweepstakes prizes for the entire State, as follows: —

First prize,	$200 00
Second prize,	150 00
Third prize,	100 00

Four hundred and fifty dollars in cash prizes are also offered for dairies best protected from flies,[1] as follows: —

First prize,	$100 00	Fourth prize,	$70 00
Second prize,	90 00	Fifth prize,	60 00
Third prize,	80 00	Sixth prize,	50 00

This latter contest is open to all Massachusetts dairies of five cows or more, whose owners are practical farmers superintending their own dairies. Separate entries required. Entries close August 30.

Entry blanks may be obtained of the State Board of Agriculture, 136 State House, Boston, Mass.

Rules for Clean Milk Contest.

1. These prizes are open for contest only to dairies of five or more cows in this Commonwealth, whose owners are practical farmers superintending their own dairies.

[1] For report of this contest see Circular No. 10.

2. All entries for prizes in the eastern section, comprising Essex, Middlesex, Suffolk, Norfolk, Bristol, Plymouth, Barnstable, Dukes and Nantucket counties, must be made on or before Aug. 30, 1913. Those in the western section, comprising Worcester, Franklin, Hampshire, Hampden and Berkshire counties, must be made on or before Sept. 30, 1913.

3. Dairies will be visited at times most convenient for the agents. Owners shall be notified in ample time, and must not commence milking until after the agent arrives. One visit to each dairy will be made by the agent for the purpose of taking the milk sample, and, if through fault of the contestant the agent is not able to obtain such sample at the time of his visit, said contestant shall thereby forfeit all claims in this contest.

4. A sample from the hand-drawn, unstrained, mixed milk from five or more cows will be taken and tested for sediment.

5. The dairies must be open for full and complete inspection, and questions asked by the agents must be fully answered.

6. Each dairy shall be numbered by the agent, and that number, known only to him, shall be written upon the paper holding the sediment sample and sealed in a suitable receptacle. The same number shall be written upon a card, containing the name of the owner of the dairy, and sealed in an envelope. These cards and samples shall be delivered to the general agent of the Dairy Bureau of the State Board of Agriculture. The envelope, containing the name of the owner, shall not be opened until after the awards have been made.

7. The prizes will be awarded by competent experts, and the decision of these judges shall be final.

8. No prize shall be allowed for milk that is not meritoriously clean.

9. In case of ties, prizes shall be equally divided.

10. Announcement of the prizes awarded in the eastern section may be made at the Brockton Fair, September 30. Announcement of those in the western section, and of the sweepstakes prizes for the State, will be made at the public winter meeting of the State Board of Agriculture, in Springfield, December 2.

Rules for Protection from Flies Contest.

In awarding prizes in this contest the following points will be emphasized: —

Means adopted to prevent fly breeding, including the disposal and treatment of manure, refuse, etc.

Thoroughness in screening.

Best methods of trapping.

General effectiveness of the whole scheme.

1. (Rule 1 as printed above.)
2. All entries must be made on or before Sept. 1, 1913.
3. (Rule 5 as printed above.)

4. (Rule 7 as printed above.)
5. No prizes shall be awarded unless, in the opinion of the judges, they are fully merited.
6. (Rule 9 as printed above.)
7. Announcement of awards will be made on or before Dec. 2, 1913.

BOSTON, MASS., August, 1913.

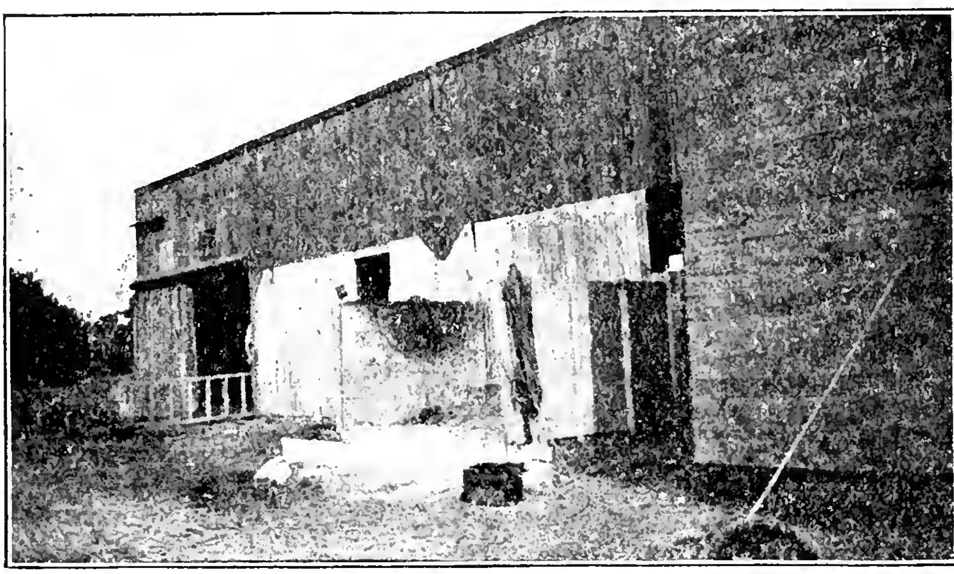
In response to the above notice, 37 eligible contestants entered the clean milk contest in the eastern section, and 114 in the western section. Eighteen contestants entered the protection from flies contest.

In the clean milk contest an agent was sent to each farm who obtained from the owner replies to a list of questions with which he was provided, and who took photographs, both interior and exterior, of the stables, etc. The milk of five cows, drawn in the presence of the agent, was thoroughly mixed by means of stirring with a long-handled dipper, after which one pint of milk was dipped out and run through a sediment tester. The absorbent cotton in the bottom of this tester was then removed and attached to a small piece of round filter paper and placed in a box which contained a number. This box was then sealed. The agent, provided with a card bearing the contestant's name, then wrote the number of the box upon the card and sealed the same in an envelope. Both box and card were afterwards turned over to the general agent of the Dairy Bureau in whose possession they remained sealed until handed to the judge, Prof. Samuel C. Prescott of Massachusetts Institute of Technology, who placed the entire 37 contestants in the eastern section, and the first 50 in the western section, in their proper order. After the prizes had been awarded the envelopes were opened and it was then ascertained who had won them. It should be here stated that nearly all the cottons showed well for unstrained milk, and the only reason why some failed was not because of very dirty cottons but simply because some one else had a slightly cleaner one. In many cases a magnifying glass was necessary to determine the difference.

A brief description of the methods of the several successful contestants is as follows: —

Report of Clean Milk Contest, Eastern Section, 1913.

The winner of the first prize in the eastern section, State Board of Agriculture clean milk contest, 1913, was Mr. Edmund B. Hutchins of Stoughton. Mr. Hutchins owns a farm of 30 acres and keeps 14 cows. He has lived on his present farm since 1909. In July, 1912, his barn was burned. He then fixed over an old shed in which he now keeps his cows. Since the cows have been thus housed he has won four first prizes for clean milk as follows: at Amherst,



Edmund B. Hutchins' Stable.

Massachusetts Dairymen's Show, March, 1913, first prize in special class for milk from 10 cows, a Guernsey bull calf, which in turn won first prize in his class at the Brockton Fair in October and was later sold for $100; at Brockton, Massachusetts Dairymen's Show, October, 1913, first prize in class 1, milk of 5 cows entered; at the Massachusetts Dairymen's Show, State Board of Agriculture meeting, Springfield, December, 1913, first prize in class 1, milk of 4 cows entered; and the State Board of Agriculture prize of $100 in the eastern section contest, above noted, September, 1913. The total money value of these prizes is $255. His bacteria count at Amherst show was 400, at Brockton, 500 and at Springfield, 1300 per cubic centimeter. Mr Hutchins washes and wipes the udders before milking and uses a small-top copper pail of his own design. His cows are kept reasonably clean all of the time. He retails his milk at 9 and 10 cents per quart.

Mr Kenneth E. Webb, Needham, winner of the second prize in the eastern section, is comparatively new in the business. He with his brother purchased a farm of 144 acres three years ago and engaged in the milk business. They keep 31 cows. The stable is made out of what used to be an old hay barn and stable combined. Mr. Webb retailed his milk at 9 cents per quart before he won the prize, but after the announcement in the local paper that he had won second prize, he was besieged by applications for more milk. He advanced the price 1 cent per quart, and says that he is now receiving $100 more per month than he did formerly, thus showing that there is a demand for clean milk for which people are willing to pay a reasonable price.

Mr. Fred Miller, Methuen, winner of the third prize, has a farm of 150 acres. He has a modern barn with a wing stable with monitor roof. He keeps 48 cows. Milkers are required to wash their hands before milking. Flanks and udders are wiped with a damp cloth. Cows are groomed every day in winter. Floors are sprinkled to lay dust. Mixing tank is kept covered. Milking is done in small-top pail. Milk is retailed from 8 to 12 cents per quart.

Mr. C. Herbert Poore, Haverhill, winner of the fourth prize, owns a farm of 40 acres. He has a barn with basement stable and keeps 30 cows. Milkers are required to wash their hands before milking. Cows' flanks and udders are washed twice daily and grooming is also done twice a day. He uses a milk pail of his own manufacture with a small opening in the top. The pail is so constructed that it is also used as a milking stool. Milk is retailed at 12 cents per quart.

Mr. Manuel G. White, North Falmouth, owns a farm of 48 acres and keeps 6 cows. He has an old-style barn with a stable in main barn on floor level over cellar. Milkers are required to wash their hands before milking. Flanks are brushed and wiped with a clean cloth. He uses a half-closed pail to milk in. Milk is retailed at 12 cents per quart.

Mr. Ernest W. Burks, Natick, winner of the sixth prize, owns a farm of 14 acres and keeps 25 cows. He has an excellent modern barn with wing stable with monitor roof. The floor and walls are of cement. He washes his hands before milking. Udders and flanks are brushed and washed and wiped daily. He uses milk pail with a sliding cover. Milk is retailed at 9 cents per quart.

Mr. Horace Holmes, Kingston, winner of the seventh prize, has a farm of 14 acres and keeps 6 cows. He has an old-style barn; the stable is in the form of a lean-to against the barn. He washes his hands before milking, and flanks and udders are wiped with a damp cloth. He milks into a sterilac pail, and milk is wholesaled for 45 cents per $8\frac{1}{2}$-quart can.

Messrs. G. C. and W. C. Wilkins, Plainville, winners of the eighth prize, have a farm of 80 acres. They have an old-style barn with stable in main barn on floor level with cement floor. A small-top pail is used. Udders and flanks are kept clipped all the time and are brushed and washed. Milk is retailed at 9 cents per quart.

Mr. Walter S. Holder, Chelmsford, winner of the ninth prize, has a farm of 30 acres and keeps 6 cows. He has a small neat barn with stable in main barn on floor level over cellar. An open-top pail is used. He washes his hands before milking, wets down the stable with a sprinkler, wipes flanks and udders with a wet cloth. Milk is sold at wholesale at 40 cents per $8\frac{1}{2}$-quart can.

Mr. Frank W. Chase, Oak Bluffs, winner of the tenth prize, has a farm of 150 acres and keeps 21 cows. He has an old barn with lean-to stable. He milks into an open-top pail. Stable is sprinkled to lay the dust. Udders and flanks are wiped with a clean, white cloth. Milkers are required to wash their hands before milking. Milk is sold at 10 cents per quart.

Miss Helen Holmes, Kingston, winner of the eleventh prize, has a farm of 90 acres and keeps 20 cows. She has an old barn with a modern wing stable and cement floor. It is well lighted and ventilated by the King system. Open-top pails are used. Milkers are required to wash their hands before milking. The stable is wet down to lay the dust. The flanks are wiped with a damp sponge, and the udders are wiped with a damp cloth. Milk is retailed at 10 cents per quart.

Mr. Harry F. Carpenter, Attleborough, winner of the twelfth prize, has a farm of 40 acres. The stable is in the main barn on floor level over the cellar. He uses a small-top pail. Milkers are required to wash their hands before milking. Udders are wiped with damp cloth and flanks are brushed. Milk is sold for 6 cents per quart.

Mr. John Quinn, Kingston, winner of the thirteenth prize, has a farm of 30 acres and keeps 15 cows. The stable is in the main barn on floor level over cellar. He milks into an open-top pail. Milkers are required to wash their hands before milking. Cows are brushed and udders and flanks are wiped with a damp cloth. Milk is retailed at 9 cents per quart.

Mr. Benjamin W. Shaw, South Weymouth, winner of the fourteenth prize, owns a farm of 42 acres and keeps 27 cows. The stable is in the basement and has a cement floor which is washed once a week. Cows' flanks and udders are washed and wiped. He uses a small-top pail. Milk is sold at 9 cents per quart.

Mr. John H. Ahola, Lanesborough, winner of the fifteenth prize, owns a farm of 2 acres. He keeps 13 cows. He has an old barn with the stable in the main barn on floor level. A small-top pail is used to milk in. Milkers are required to wash their hands before milking. Flanks and udders are wiped with a damp cloth. Cows are groomed daily in winter. Milk is sold at retail for 7 cents per quart.

Messrs. Crosby & Flitner, Billerica, winners of the sixteenth prize, have a farm of 35 acres and keep 16 cows. The stable is in the main barn over the cellar. An open-top pail is used. Cows are groomed daily when stabled.

Milkers are required to wash their hands before milking. Milk is sold at wholesale at 36 cents per can.

Mr. Josiah Q. Packard, Brockton, winner of the seventeenth prize, has a farm of 84 acres and keeps 35 cows. The stable is in the form of an extension from the main barn. He milks into a hooded pail. Flanks and udders are brushed before milking. Milk is retailed for 9 cents per quart.

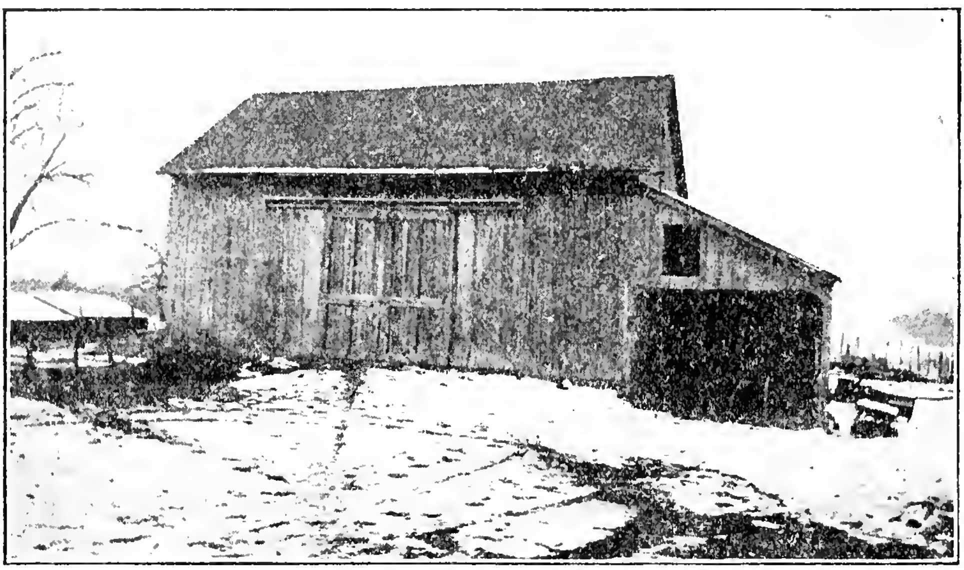
Mr. Charles S. Bisbee, Haverhill, winner of the eighteenth prize, has a farm of 35 acres and keeps 6 cows. The stable is in the main barn over the cellar. He milks into an open-top pail. He washes his hands before milking. Flanks and udders are brushed with hands. Milk wholesales at 40 cents per can.

Mr. Marcus C. Southworth, Brockton, winner of the nineteenth prize, has a farm of 105 acres and keeps 80 cows. The stable is in the form of an extension from the main barn. It is well lighted and ventilated. He milks into an open-top pail. The stable is wet down to lay the dust. Flanks and udders are washed. Milk is sold at 9 cents per quart.

Mr. José Pontes, Swansea, winner of the twentieth prize, has a farm of 44½ acres and keeps 7 cows. The stable is in the main barn on floor level. He milks into an open-top pail. He washes his hands before milking. Udders are wiped with a damp cloth. Milk is wholesaled at 44 cents per can.

Report of Clean Milk Contest, Western Section, 1913.

The first prize in the western section, State Board of Agriculture clean milk contest, 1913, and also first sweepstake prize in the same contest, was won by Mr. Peter Kronvall, East Longmeadow. Mr. and Mrs. Kronvall are both natives of Sweden and have lived in this country thirty years. When they came here Mr. Kronvall worked in a stone quarry, and fourteen years ago they decided to buy a farm, and purchased the one on which they are now living. Mr. Kronvall does not know how to milk and does not care for cows, but his wife urged him to stock the farm and promised him, if he did so, that she would do the milking herself. When Mrs. Kronvall was ten years old her mother was taken seriously ill, and there was no one else to do the milking but this little girl of tender years. She conscientiously milked the cow just as she had seen her mother do it. From that day to this Mrs. Kronvall has milked cows in no way different from the way she was taught, and she did no differently in this contest. Her system of milking consists of first fastening the tail to the cow's leg with a small cord and then, with a little warm



Peter Kronvall's Barn.

water, rapidly washing the udder and wiping it dry with a clean cloth. These preparatory measures are performed with great rapidity, occupying only one or two minutes. She then holds the pail between her knees just out from under the cow. It will be seen that in this position no dirt can fall from the cow into the pail. The milk from this farm is sold to an Italian peddler who distributes the milk along Water Street and vicinity, the poorest section of Springfield. After the announcement of the winning of the prizes was made in the local papers, many calls were received over the telephone from the wealthy section of Springfield for milk from this farm. The total winnings of Mr. Kronvall in this contest amounted to $300.

Mr. Joseph S. Hillman, Hardwick, winner of the second prize and second sweepstake prize, totaling $245, has a farm of 96 acres and keeps 16 cows. He has a modern, well-lighted stable with monitor roof, and abundant air space. He wipes flanks with burlap, and grooms daily in winter. He uses both small-top pails and 10-quart cans to milk in. Milk is sold at 45 cents per 10-quart can to Springfield contractor. Mr. Hillman did the milking himself in this contest and used a 10-quart can.

Mr. Rufus H. Randall, Bolton, winner of the third prize and the third sweepstake prize, totaling $190, has a farm of 101 acres and keeps 18 cows. He has a barn with a stable inside over cellar. A damp sponge is used to wipe flanks and udders. He uses a small-top pail. The milk is sold at wholesale for 50 cents per can and eight cents per quart retail, and is marketed in Clinton. Mr. Randall did the milking himself in this contest.

Mr. Willard M. Cooper, Agawam, winner of the fourth prize, has a farm of 85 acres and keeps 18 cows. The stable is in the main barn on floor level; there is no barn cellar. He wipes flanks and udders with a damp cloth, and grooms daily in winter. A small-top milk pail is used. Milk is sold to a Springfield peddler at 50 cents per 10-quart can. Mr. Cooper did the milking in this contest.

Mr. Clarence B. Brown, Brimfield, winner of the fifth prize, has a farm of 175 acres and keeps 22 cows. He has a barn with modern stable extension in the form of a wing with a cement floor. He washes and wipes flanks and udders before milking. A small-top pail is used. He makes butter which he sells at 40 cents per pound. Skim milk is fed to pigs and hens. Mr. Brown did the milking himself in this contest.

Mr. Sylvester Spellman, East Longmeadow, winner of the sixth prize, has a farm of 70 acres and keeps 21 cows. He has a well-lighted stable with a cement floor. He wipes the flanks and udders with a damp cloth, and grooms daily in winter. A small-top pail is used. Milk is sold in Springfield at $47\frac{1}{2}$ cents per 10-quart can. Mr. Spellman did the milking in this contest.

Mr. William H. Morey, Cummington, winner of the seventh prize, runs a farm of 400 acres and keeps 21 cows. He has a barn with a basement stable in which is a cement floor. He brushes off flanks and udders with hands. Cows are groomed twice a week in winter. An open-top pail is used. He sells cream to Cummington Creamery, receiving 36 cents per pound for butter fat. He did the milking himself in this contest.

Miss M. Anna Cleveland, Hardwick, winner of the eighth prize, runs a farm of 330 acres and keeps 30 cows. She has an old-style barn with stable over barn cellar. Flanks and udders are wiped with a dry cloth. Cows are groomed daily in winter. Milk is sold to Springfield contractor for 45 cents per 10-quart can. The foreman, Mr. Brewster, did the milking in this contest.

Mr. Oscar C. Pomeroy, Longmeadow, winner of the ninth prize, has a farm of 125 acres and keeps 23 cows. Stable is in a lean-to on floor level over cellar. He wipes the flanks and udders with a damp cloth, and grooms daily in winter. A small-top milk pail is used to milk in. Milk is sold in Springfield at 8 cents per quart retail and 5 cents per quart wholesale. Mr. Pomeroy did the milking himself in this contest.

Mr. Marchant M. Martin, Southborough, winner of the tenth prize, has a farm of 58 acres and keeps 9 cows. His stable is an extension to an old barn. It is well lighted and ventilated, and has a cement floor. Udders and flanks are washed, and cows are groomed daily. He does his own milking. Milk is sold at 28 and 40 cents per $8\frac{1}{2}$-quart can.

Mr. Joseph C. White, West Springfield, winner of the eleventh prize, has a farm of 150 acres and keeps 12 cows. He has an old-style barn with stable which has a cement floor. Flanks and udders are washed and then wiped with dry burlap. A small-top pail is used to milk in. Milk is sold at 50 cents per 10-quart can in Springfield. Mr. White did the milking himself in this contest.

Mr. Charles J. Nelson, Agawam, winner of the twelfth prize, has a farm of 252 acres and keeps 8 cows. He has an old-style barn with a lean-to stable. Udders and flanks are wiped with a damp sponge, and cows are groomed the year around. He milks into a small-top pail. Milk is sold in Springfield at 45 cents per 10-quart can.

Mr. Hermon W. King, East Longmeadow, winner of the thirteenth prize, has a farm of 85 acres and keeps 20 cows. He has an old-style barn with stable in end with wooden floor. Flanks and udders are wiped with a damp cloth; he grooms five times a week in winter. Floors are sprinkled before milking. Small-top milk pail is used. Milk is sold in Springfield at 50 cents per 10-quart can. Mr. King did the milking himself in this contest.

F. J. Pomeroy & Son, Agawam, winners of the fourteenth prize, have a farm of 100 acres and keep 24 cows. The stable is in the main barn on floor level over cellar. Flanks and udders are wiped with a damp cloth. A small-top pail is used to milk in. Milk is sold at wholesale for 7 cents per quart, and at retail for 9 cents per quart. Milk goes to Springfield. Mr. Pomeroy's son did the milking in this contest.

Mr. Dana S. Moore, West Springfield, winner of the fifteenth prize, has a farm of 180 acres and keeps 15 cows. The stable is in the main barn on floor level. He wipes flanks and udders with a damp cloth before milking. A small-top pail is used to milk in. Milk is sold in Springfield at 45 cents per 10-quart can. Mr. Moore did the milking in this contest.

Mr. John B. Walker, Orange, winner of the sixteenth prize, has a farm of 89½ acres and keeps 6 cows. He has an upright frame barn with stable on floor level over cellar. He brushes and wipes flanks and udders with a damp cloth, and grooms cows daily in winter. He uses a small-top milk pail. Milk is sold for 5 and 6 cents per quart. He did the milking himself in this contest.

Mr. James Lawton, East Longmeadow, winner of the seventeenth prize, has a farm of 100 acres and keeps 10 cows. His stable is in the main barn on floor level over cellar. He wipes flanks and udders with a damp cloth. A small-top milk pail is used. Milk is sold in Springfield at 45 cents per 10-quart can. The hired man, a Polander, did the milking in this contest.

Mr. Leander W. Newton, Southborough, winner of the eighteenth prize, has a farm of 17 acres and keeps 10 cows. He has a stable in the form of a lean-to against the main barn. The stable has a cement floor and large air space. He washes flanks and udders, and grooms every other day. A small-top pail is used to milk in. Milk is sold at 50 cents per $8\frac{1}{2}$-quart can and goes to the Deerfoot Farms' dairy. Mr. Newton did the milking in this contest.

Mr. Henry S. Ashley, East Longmeadow, winner of the nineteenth prize, has a farm of 89 acres and keeps 18 cows. His stable is in main barn on floor level over cellar. Flanks are wiped with a dry cloth, but udders are washed. A small-top milk pail is used. Cows are groomed daily in winter. Milk is sold in Springfield at 50 cents per 10-quart can. Mr. Ashley did the milking in this contest.

Mr. William Reimers, Monson, winner of the twentieth prize, has a farm of 130 acres and keeps 8 cows. His stable is in the main barn on floor level. Flanks and udders are wiped with a damp cloth. He uses a small-top milk pail. Milk is sold at 47 cents per 10-quart can in Springfield. Both Mr. Reimers and his son milked in this contest.

One lesson stands out prominently in this contest, and that is the importance of giving strict attention to *keeping dirt out of milk.* The person who does this most efficiently wins the prize. Clean stables and clean surroundings are all right as far as they go, but one careless milker spoils all the expense and pains taken by the conscientious owner, while a painstaking, clean milker can obtain clean milk under much less favorable conditions.

All of the above-named contestants cheerfully signed the following expression of determination at the close of the contest: —

Consideration of the generosity of the Commonwealth in offering liberal prizes for the production of clean milk, together with my own interest in the matter, leads me to express my determination to continue the means adopted in this contest and to add thereto from time to time such improvements as appear practical, to the end that the present high standing of Massachusetts milk may be maintained and its quality improved.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 14.

March, 1914.

THE CULTURE OF THE CURRANT.

By U. P. HEDRICK, Horticulturist of the New York Agricultural Experiment Station.

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CURRANTS.

BY U. P. HEDRICK.

Currants ripen at a time of the year when other fruits are scarce, and therefore play an important part in fruit growing, both for home use and for the markets. Moreover, their sprightliness of flavor and healthfulness commend them for the home garden, while the fact that they can be picked and sold before fully ripe, and therefore bear shipment well and with but little waste, commends them for market purposes. The currant is a northern plant and refuses to grow in any but a cold climate. It stands well the lowest temperature reached in the United States, but is quickly injured by hot summer suns. In selecting a location for this fruit, then, even in northern latitudes, a cool, northern exposure is desirable. For small plantations the shade of trees or of buildings can often be utilized, while in commercial plantings high land may be made to offset low latitude.

Soils.

The currant will bear fruit in almost any soil, but to produce profitable crops it should be planted in a cool, moist soil. Clay loams, or even a stiff loam, if well drained, meet well the soil requirement of the currant. The plant is a rank grower, and whatever the soil, it must be rich. Moreover, the roots do not extend far, and the food must therefore be close at hand. Stable manure is a most acceptable fertilizer, but should be applied the season previous to the setting of the plants, or in old plantations the application should be made in the fall or winter. Many currant growers maintain that muriate or sulphate of potash used at the rate of from 100 to 200 pounds per acre increases productiveness and adds quality to the fruit. Probably, however, the fertilizer requirements of the plant are best determined by individual experiments with potash, phosphoric acid and nitrogen.

Propagation.

Since the currant is easily propagated, growers of this fruit can often raise their own plants advantageously, the process being as follows: as soon as the leaves fall in the autumn make hardwood cuttings varying in length from 6 to 10 inches. In dry climates and in light soils the longer length is preferable, while in moist and rich soils the shorter length will suffice. The cuttings may be put in the ground as soon as made or, and perhaps better, they should be tied in bundles and buried butt end up in moist sand until spring. When the planting season arrives, which should be as early as possible in the spring, the cuttings are set from 4 to 6 inches apart rather deeply in the soil, leaving one or two buds above the surface with the earth pressed firmly about the butts. If fall planting is preferred the cuttings are thought to root rather more quickly and better if packed in damp moss for a week or two before planting. Fall set cuttings must always be mulched during the winter. The cuttings will start in almost any soil, but do somewhat better in a rich, moist one. The following fall these cuttings should be set in nursery rows, the plants being 8 to 10 inches apart, and the rows 3 feet. Here they should be left one or two years and kept cultivated.

Planting.

Either one or two year old plants may be used in starting a plantation, but, all things considered, the two-year-old plants are the better. The commonest distance apart is 6 by 4 feet, though the tendency is to give greater distance in the row, which permits cultivation both ways. Since the plants form a comparatively permanent plantation the land should be well drained, and in the best possible tilth at setting time. The transplanting is quickly and cheaply done by marking both ways and plowing a deep furrow one way and then setting the plants at the intersection of furrow and mark. In all but very cold climates the planting can best be done in the fall, and if severity of climate makes it necessary to set in the spring the work should be done as early as possible. There are no difficulties about transplanting, but the usual precautions of trimming roots and tops and of firming the earth should be observed.

Cultural Treatment.

The currant fruits early and the plant makes its growth early; therefore, it is urgent that the cultivation be early, thorough and frequent to conserve moisture and set free plant food. All of the varieties of the currant are shallow rooted, and the cultivation must of necessity be shallow to prevent injury to the roots and for that reason plowing is impossible. In growing the currant for home use it is often convenient to mulch with straw or coarse stable manure in place of cultivating. In commercial plantations such mulching can seldom be made to give as good results as careful cultivation. In midsummer cultivation should cease and a cover crop be planted. Probably the best cover crop is one of clover or vetch in combination with oats or barley, to be sown in late July or early August; 12 or 15 pounds of clover seed to the acre and 20 or 25 pounds of vetch, sown with a half bushel of oats or barley, give proper proportions of seed.

Pruning.

Left to themselves currant plants rapidly become thickets, to prevent which there must be yearly pruning, which consists for the most part in removing old canes and thinning out new ones. In the pruning encourage an upright growth or the bush form with several stems rather than a straggly habit with but few stems. From four to eight stems are desirable, depending upon soil and variety. Aim to keep a continuous supply of vigorous shoots coming on. In well-pruned plantations no wood over three years old should be found. In pruning keep in mind that the best fruit is borne at the base of the one-year-old shoots, and on one-year-old spurs on two and three-year-old wood. Vigorous shoots may occasionally be headed in, particularly if the plants be young, but heading in ought not to be often necessary. The plantation should be removed or renewed as soon as vigor wanes, which is usually at ten or twelve years, depending upon variety, soil and treatment.

Harvesting.

There are several essentials to harvesting currants for market purposes. Chief of these are that the fruit must be dry when picked, not too ripe but hard and firm, and that the clusters be intact. So picked the fruit stands shipment well even to distant markets, but if the items named be overlooked the product often quickly spoils even in sending to near-by markets. Of course the nearer the market the riper the fruit may be allowed to become. Fruit for jelly should not be fully ripe. For home use picking can be delayed until the fruit is quite ripe, and may often be kept on the plants until midsummer if the bushes be protected from birds by covering with netting. Currants are commonly marketed in quart baskets or in grape baskets. In the former case they are shipped in crates holding 16 or 32 quarts. The 8-pound grape basket is now preferred in many markets, and is the more convenient way of shipping, both for the producer and the buyer.

Profits.

Profits vary greatly, but year in and year out this fruit gives very good returns, though in many cases the market must be developed or vigorously sought for. While many plantations do not yield more than 50 bushels to the acre, crops of from 100 to 250 bushels per acre under good culture are not uncommon. Unfortunately, the price fluctuates rather more than for most other fruits, and the small local markets are usually supplied from home gardens. Canning and jelly factories use this fruit in large quantities, and commercial growers ought to know before planting that they have an outlet for the sale of a part of their crop for canning or jelly. A fair average of the price paid for currants at the factory would be 5 cents a pound.

Pests.

The currant suffers from several pests of which the currant worm, familiar to all, is most troublesome. This worm is to be found throughout the eastern part of the United States in all plantations, and must be combated if a profitable crop is to be grown. Happily, it is easily poisoned with any of the arsenical sprays or, if it has been permitted to continue its depredations until near fruiting time, powdered hellebore at the rate of a teaspoonful to a gallon of water is an effective remedy. The currant borer is also a serious pest in many parts of the east. With a little experience infested canes can easily be told, and the pest can be controlled by cutting out and destroying such canes in early spring. The San José scale also attacks the currant, and may be given the same treatment as on other fruits. One of the oil sprays is better than lime and sulphur on currant bushes, as the scale sometimes gets on the branches below the ground, and so a spray is needed which will spread. In eastern Massachusetts the bushes must be watched for the eggs and nests of the brown-tail and gypsy moths. Both of these can be detected and destroyed in winter. These are the only pests requiring constant looking after, though several fungi infect the plants more or less in different localities and may need treatment with fungicides. Commercial plantations should be sprayed with fungicide and an arsenical as soon as the fruit begins to swell, and again with a fungicide immediately after the fruit has been picked.

Varieties.

The following list should be considered in selecting varieties for either home or market purposes. It includes the standard kinds and several new sorts which are well worth trying.

The Cherry is a standard sort, with large but short clusters produced in great abundance.

Diploma is comparatively new, but to be commended because of its vigorous, upright habit of growth and large, light red, semi-transparent berries.

Fay succeeds remarkably well in some locations, but fails in others. Its sprawling habit of growth is a defect.

Perfection is a comparatively new kind much above the average in flavor; vigorous, productive and of good habit of growth.

Red Cross is liked by some because of the mild flavor of its fruit and its lateness.

Red Dutch, an old sort with small fruit, is still prized by some.

Ruby is a mild-flavored variety very suitable for home use.

Wilder is one of the best late varieties; the bush is very vigorous, the fruit large and the season long.

All of the above are red currants. In some markets there is a demand for white sorts which are usually milder in flavor. Of the white varieties White Imperial is the most desirable because of its mild and very pleasant flavor. White Grape, however, produces larger and more attractive fruit than White Imperial.

Black currants belong to a different species than the red and white sorts, but thrive under essentially the same culture, demanding only a little more room. The fruit to those unaccustomed to it is not pleasant in either odor or flavor, but it is much esteemed by those who have learned its use, both as a dessert fruit and because of medicinal qualities. The strong musky flavor disappears in part if the currants be scalded for a few minutes in boiling water and then cooked in fresh water. Champion and Prince of Wales are by far the best of the several black currants.

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CANTALOUPE GROWING IN MASSACHUSETTS.

By J. M. S. Leach, Sunderland, Mass.

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

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CANTALOUPE GROWING IN MASSACHUSETTS.

J. M. S. LEACH, SUNDERLAND, MASS.

Probably the melon does not strictly belong in New England, but in a hotter, more equable climate, with a longer season. Of necessity, therefore, we raise it under many difficulties, and seldom with a perfect degree of success.

But the fruit, when successfully grown, is so delicious in flavor, and so universally popular, that the effort to produce it, even under circumstances not entirely favorable, seems well worth while.

The wandering Israelites complained that they could not forget the melons of Egypt, and if they were good ones, it is hardly to be wondered at.

There are many influences that go into the making of a crop of melons, many of them beyond the control of the grower. This bulletin is an effort to deal with those conditions that he can govern.

Soil.

A light loam is generally preferred. Melons do best if they are planted on land which has been in clover or alfalfa sod the previous year, as the nitrogen of the decaying roots and stubble is very beneficial to the melons. There is no question that this one thing often makes the difference between a record crop and a poor one. Good crops, however, are grown on old land.

Early Melons.

To escape the early frosts of fall is only a secondary reason for growing melons early in this latitude. The primary reasons are that the earliest of the melon crop is sold with less competition, so that sales are easier and prices better; and that marketing is well advanced before the dog-days, with their rains and "muggy" heat, set the ground to steaming, and in consequence the vines to blighting.

To get an early start one should get the seed in the ground as early as the late frosts will permit, and as soon as the ground is warm enough for germination. Some prefer to gain time by starting the plants under glass. This is at best a delicate operation and requires patience and study.

Many of the great melon growers of the Arkansas valley start them in cold-frames with success, and claim a hardier plant is grown than in a hotbed; but the writer, in several years' trial, has always encountered some difficulty in getting a good stand in cold-frames. Perhaps there is too much cloudy weather in our early spring for the beds to warm up sufficiently.

A hotbed, though more expensive, overcomes the difficulty, and if well handled insures a good germination and continuous growth. Such a hotbed requires 1½ or 2 feet of horse manure in the bottom, which should be put in, leveled and trodden enough to make a level floor for the receptacles in which the seeds are sown. Plant boxes or inverted turf may be used for these. We use some of both. With boxes, finely composted manure may be mixed with rich loam for filling. The manure may be screened through an inch-mesh screen made of old telephone wire. If preferred, manure may be put in the bottom of the boxes, pressed down, and the loam put on top. If the loam is sterilized with steam, the weed seeds will be killed, so that the necessity of weeding the beds may be obviated. The "damping off" fungus will also be destroyed, and the growth of the plants be greatly promoted by sterilizing. Success can, however, be attained without it. The boxes may be bought in the flat, and tacked together as used. These should be filled level full.

If turf is used, it is preferable to select in the fall the place where it is to be cut, spreading on a coat of stable manure to enrich it. The sod may be cut into 5 or 6 inch squares, about 5 inches thick, and laid soil up, on the manure of the hotbed. After all is ready the glass should be put in place for two or three days, to allow the bed to warm up, after which it is ready for the seed, provided that the soil has reached a uniform temperature of about 80°. The hotbed needs to be under the care of some one who will not forget it.

So long as the beds are kept moist, and until plants begin to come up, temperature running up to 120° will do no harm. When the plants are up, 100° is all right for the first ten days; after that a lower temperature will do.

These, of course, are daytime temperatures. Some loss of heat will cause them to go down more or less at night, perhaps to around 80°. Ventilation must never be forgotten. The need of it increases with the growth of the plants as it is necessary that they be well "hardened off" before transplanting, and also because all the plants in the bed may be destroyed by neglecting ventilation for even an hour on a hot, bright day.

The growth of the plants may of course be promoted by light applications of hen manure and acid phosphate, but care should be used to see that the bed gets air after this application, since escaping ammonia may do injury. Or the plants may be watered with a nitrate of soda solution.

Plants should be thinned to one or two in a box in order to get a stocky plant. The proper time to transplant is when the little vines have four leaves. Transplanting may be left until there are six leaves, but should never be done earlier than the four-leaf stage. Just before transplanting time the plants must be gradually hardened by leaving off the glass.

In setting, the bed is thoroughly wet down, after which the boxes or turfs are loaded on a wagon and taken to the field. They are placed in the furrow and the soil drawn around them with a hoe. In case boxes are used they are cut away as the cube of wet earth is placed in the ground. If the plants are hoed at once and frequently, watering is seldom necessary.

Field Planting.

Two things should be fixed in the mind with this system of planting. Since the early start of the crop is important, the soil should be put into the finest possible tilth for the seed, because such condition not only insures their early germination, but makes the plant food more available. Depth of planting should be determined somewhat by the condition of the soil, a light, dry soil and dry weather requiring deeper planting. If planted too deep they are slow in coming, and reach the surface in weakened condition; if too shallow, the seed will dry up. Perhaps 1½ inches is a fair depth for average conditions. Seed should be used liberally to allow for losses from insects.

Hills are generally placed 6 by 6 or 6 by 4 feet. Thin to two plants when cutworms and bugs are gone. Some seed in drills with a seed sower, thinning later to single plants 1 or 2 feet apart. Before the plants come up the soil sometimes gets baked on the surface of the hill, and needs to be loosened by the fingers, or by passing a garden rake lightly over it with a lifting motion.

The critical period in the entire life of the melon plant is the first fortnight after it comes up. It is the start of the race, and everything depends on the plant getting away without a handicap, for a cantaloupe vine never recovers from a setback.

To understand the importance of care at this stage it is necessary to notice the structure of the plant. Pull one up and you will see that you have the two-seed leaves with a tuft between where the true leaves are waiting to come out, while below the surface there is nothing but the stem tapering into one long, stringy root running straight down into the ground. Now keep this state of the plant in mind while you notice that for days all the plants in the hill seem at a standstill. What are they waiting for? Simply for their mouths! Pull up another plant now and you will see roots putting out laterally on all sides of the taproot. These are the feeders, and as they push out into your finely prepared soil on every hand watch the plants spring forward into life and growth; the first true leaf unfolds in a day. The vine is off with a rapid growth that must never be checked for a moment till its work is done.

But here is the important point. At this stage the plant needs a nurse. Nothing in these first few days must be allowed to trouble it, — neither the striped beetle that would sting its stem and sap its leaves, nor the wind that would wrench and twist its delicate stem, nor the heat and drought that would burn the soil and make it too dry for the infant feed roots to take their first taste of food and drink, and to reach out into the surrounding soil for the nourishment for which the tiny plant above ground is waiting.

Hoeing at this time will do more good than at any other in the life of the plants. It mulches them and protects their scant roots. The drawing of the soil up around the plants braces them against destructive winds, while working about the hills tends to scare away the striped beetle, which is very timid. The hoe must be used with great care, however, on account of the shallowness of the roots.

Fertilizing.

Barnyard manure seems to offer the best and safest means of feeding the melon plant. Variation in opinion as to the method of application is wide. Manuring in the hill is the most common practice, and under irrigation or elsewhere where there is plenty of water it is the most economical way. But if one's crop must suffer each summer from drought, that effect will undoubtedly be aggravated by a lot of coarse manure in the hill. This is especially clear when we recall that chemically all decaying is burning, differing only from the burning of fire in its slower action. Thus you create a little drought of your own under each hill, a wholly unnecessary provisión in recent years in Massachusetts.

This drying-out process is augmented by the fact that the thick pad of manure tends to retard capillary movement of water from below. Therefore, if the manuring in the hill plan is to be followed, the manure should be thoroughly mixed with the soil. Considering our dry summers, the writer prefers scattering the manure along a furrow and working it into the soil with a spiked-toothed cultivator set as narrow as possible. We sometimes do this in the fall. Broadcasting the manure is certainly as good a way as any except that it takes so much manure.

It may be well to add that most of those who have experimented carefully recommend manuring in the hill; but we in the east must remember that the experiments were generally tried with irrigated vines, which is quite a different matter. The common fear that the vine will not get the full benefit of manure unless it is placed immediately at the hill is wrong. Get hold of a mature cantaloupe vine and work the main roots carefully out of the soil. You will find them longer than the vines. The writer has frequently dissected a root out of the ground between 4 and 5 feet long, without getting to the end of it. These feed roots reach everywhere, and on account of their length the melon vine can go farther than most plants in search of food. Locating the roots in this way will teach another lesson, which is that they are not far below the surface, and the cultivator must be set accordingly.

With chemical fertilizers experiments show interesting variations. Among the large growers in the irrigated sections of the west the use of such fertilizers in the hill has been attended with serious hazard, while under New England conditions the plan has often succeeded. But it must be thoroughly mixed with the soil or it is liable to burn the tender plants so that they seem to go back into the ground, or even fail to come up at all, the strong chemicals destroying the sprouting seed. A good way is to make a shallow furrow and scatter the fertilizer with a McWhorter sower, and then scratch it in with a light cultivator or some such tool.

The writer has used a mixture analyzing nitrogen 5 per cent, phosphoric acid 7 per cent, and potash 9 per cent, generally hand-mixed, as follows: —

	Pounds.
Sulphate potash (high grade),	360
Nitrate soda,	150
Sulphate ammonia,	100
High-grade tankage (9 to 10 per cent nitrogen and 4 to 6 per cent phosphoric acid),	580
Acid phosphate (16 per cent),	810
Total,	2,000

From 800 to 1,000 pounds of this mixture per acre should be applied.

Cultivation.

The importance of this subject is greatly underestimated. The grower who hoes his melons primarily to kill the weeds is a crude workman. The object should be to keep the soil stirred for a mulch, to keep fresh soil up around the plants, and to keep the soil fine to make its elements more available as food for the plants. The hand hoeing is very important. The dry, baked soil should first be drawn away from the plants, preferably by hand, and fresh, fine dirt drawn up around them with the hoe. The whole purpose of cultivation is, like fertilizing, to promote a continuous growth. As has been said, all cultivation should be shallow after growth is well started.

Enemies.

Cutworms, Bugs and Blight.

Especially following turf or a cover crop, unless it is plowed in the fall, cutworms are generally abundant and very destructive. In a small patch they may be dug out in the morning; on a larger scale they may be poisoned by a mixture of Paris green, molasses and bran, a teaspoonful dropped near the hill in the afternoon. When planting, the cutworms should be remembered and seed used rather abundantly.

The striped bugs trouble but a few days generally, but that at a critical time, when the plants are tender and young and must be protected. Land plaster or gypsum dusted over the hills will drive them away, so will ashes or dust; or a mixture may be made of these and a few drops of turpentine added. A hill is occasionally found infested with lice. This should be burned on sight, or else buried and the top of the soil under the hill scraped off and covered also. Save the ladybugs, as they feed on the lice.

Blight is to the melon vine what cholera is to the hog, — the one great enemy. It has, in its various forms, several different scientific names, perhaps unimportant here. The blight has practically driven melon growing out of New England. The scientists have given their best endeavor to the problem, and sometime they will solve it, if it can be solved. Meantime prevention must be studied, and the first step is to advance the crop as far as possible before the sultry weather of the dog-days. Insects are suspected of spreading the disease, and so should be eliminated. A steady, continuous growth should be maintained for the sake of the physical vigor of the plants. To frequent cultivation might be added a light application of nitrate of soda as the vine approaches maturity, the object being to drive the plant into the dangerous August weather with the thriftiest possible growth.

There are strains of melons called rust resistant. Their rust-resistant qualities vary under different conditions of climate and weather. On the whole, they represent an advance, but the time has not come to depend on them greatly in the east.

Spraying.

Some good results in cucumber growing have been achieved by spraying. With melons the success has not been as general; some report good, and some very indifferent, results. Variation in results is probably explained by the fact that sometimes the disease present is one susceptible to the effects of spraying and sometimes not, the bacterial wilt not generally yielding to such treatment as readily as downy mildew or anthracnose, if at all. Undoubtedly, also, the violence and rapidity of the attack vary and have their influence on the measure of success in spraying.

Under the usual circumstances melons should never follow melons in successive years. A rotation of three years, at least, is generally advisable, although one prominent grower states that he has raised melons eighteen years on the same field by sowing with rye after picking and plowing in the rye in the spring. He states that the eighteenth crop was better than the first.

Spraying must not be put off until nearly time for the blight to appear, but should be begun as a preventive measure as soon as the plants are well above the ground, and continued once in ten days or so till the fruit is safe or the vines past hope. Use Bordeaux. This will stain the fruit more or less, but that is not important.

One point in respect to spraying the writer has never seen mentioned in print, namely, its tendency to very slightly reduce the yield in the first of the season. The increase, however, in the latter part more than compensates for this early loss. The reason is that the covering of Bordeaux shades the leaf which requires sunlight, though this same effect seems to benefit potatoes, whose growth appears to be promoted by the shading.

Bees.

The writer considers a swarm or two of bees in the vicinity of the melon piece an advantage in pollenizing the blossoms. They tend to help the vines to make a larger setting of fruit, and to a more perfect condition of the melons.

Varieties.

This is a subject upon which much advice is offered, but its value is doubtful. No one can tell the prospective grower the variety that is best for him. The writer, living in the Connecticut valley, recommended certain tried varieties to a farmer in eastern Massachusetts, who proceeded to make a complete failure with them, but he went further and made just as complete a success with those that had not done well with us.

A person buying a very nice Rocky Ford cantaloupe will plant the seed because he reasons that like produces like, forgetting that the conditions have as much as the seed to do with the outcome. "That Rocky Ford melon was good, wasn't it?" "Yes." "Then why can't I grow one just like it?" "You can — in Colorado." Seed that produced a fine melon in the dry atmosphere and constant sunshine of a Colorado summer will often mold and develop deficient flavor in our more humid air. There will be exceptional cases, but that simply means that the grower happened to strike something that fitted his special conditions.

One great lesson that the eastern grower needs to learn is that the seed should be acclimated. Why is it that certain growers have won a great reputation for their product? They have adapted a melon to their soil.

Under Connecticut valley conditions the Emerald Gem is an extra early and very refined melon as to flavor, but it is not a good shipper or keeper. We raise it to supply trade till something else is ready. Next in this region may come the Extra Early Osage, or, if the market cares for them, some of the Gem type of melons, like Burrell's Gem. These are all yellow-fleshed melons. Green varieties may be selected if preferred. The beginner should try more than one kind and stick to it, and develop by selection a strain of his own perfectly adapted, if possible, to his conditions.

Hybridizing.

Just how far this subject is a legitimate subject of study and experiment to the average grower is a question. The process is interesting and occasionally profitable, but it draws on the most valuable asset the farmer has, — his own personal specialized attention. Sometimes a grower finds himself in possession of a variety that seems adapted to his locality and market, but lacks some one necessary quality which it may be worth while to try to supply by a cross with a melon that possesses it. Random crossing produces 99 inferior varieties to 1 valuable one.

In our own work our difficulty at first was to find a variety that combined flavor with standing-up quality in the market; and to this we sought to add a degree of hardihood that would carry the plant through to fall in healthy condition. In the former we feel satisfied with results. In the latter we have been only partially successful.

A peculiarity of certain vines, like the cucumber, is that they bear their stamens and pistils on different flowers. This is true of some varieties of cantaloupes, but not of others. Many melon vines produce perfect flowers, having many staminate blossoms in addition.

If it is desired to obtain something definite and known in a cross, the closed petals or corolla and stamens should be cut away from the flower just before the bloom opens, after which the flower may be covered again for a day. A small paper bag will do for this. At the end of this time it is in about the right condition to receive the pollen, which may be rubbed off on the pistil by touching it with the anthers of a freshly opened bloom. It should then be covered again for a few days.

In all such efforts the foundation melon should be selected for its flavor, and other qualities bred upon that foundation. In attaining the ends sought uniformity of size should always be considered. No plan of selling that sends to market various sizes jumbled together will ever give general satisfaction.

Picking Melons.

Roughly speaking, most cantaloupes start to loosen from the vine at the stem when ripening. Sometimes this is first detected by a drop or two of juice that oozes from the junction of the fruit and stem. Again the bottom of the cantaloupe, being on the ground, generally looks greenish white while the melon is unripe, but takes on a creamy tint approaching yellow, when ripe.

There is also, generally, a slight change in color discernible under the netting, the deep, dark green changing to an olive green. A little experience as a picker will soon obviate the necessity of any rules. A glance will tell one the stage of the fruit.

Marketing.

This is a weak spot in present-day agriculture. There are certain principles to consider and they classify themselves under two heads, — honesty and efficiency.

Honesty on the part of a melon grower is even more essential than with growers of other farm products, because the quality of the fruit does not appear until it is opened. The responsibility of seeing that his customers get good melons, therefore, rests wholly on the grower. The temptation is constant to let melons slip by the sorter that look passable, but contain nothing but disappointment to the buyer. This is both a foolish and unprofitable policy. The grower's name should go with the goods, and his name should mean quality. The goods should be so graded in respect to size as to facilitate selling, making pricing convenient. Three sizes are generally made, — Pony, Standard and Jumbo.

Goods should be marketed, as far as possible, to the same customers year after year, in order that the latter may learn to know and have confidence in the goods. When such custom has been established the grower should make it his business to take care of the buyer, and see that his needs are supplied regularly. The establishing of such mutual confidence and dependence is of equal importance to both parties.

The great but much neglected secret of marketing is to always recognize one's obligation to the buyer, to give him goods uniformly graded and priced, of absolutely dependable using quality, and to assume the obligation of seeing that his needs are always supplied.

The temptation to deliver unripe fruit and specimens of questionable quality, because prices are high and demand good, will never appeal for a moment to the grower who thinks; for he will realize that he is not merely selling goods, but building a market. There is only one place where inferior stock should be marketed, and that is the hog pasture.

That we have obstacles to melon growing in Massachusetts there can be no doubt; but half the failures would be successes if the grower made a study of the plant, its eccentricities and its needs.

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PRUNING THE GRAPE.

By Prof. U. P. Hedrick.

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

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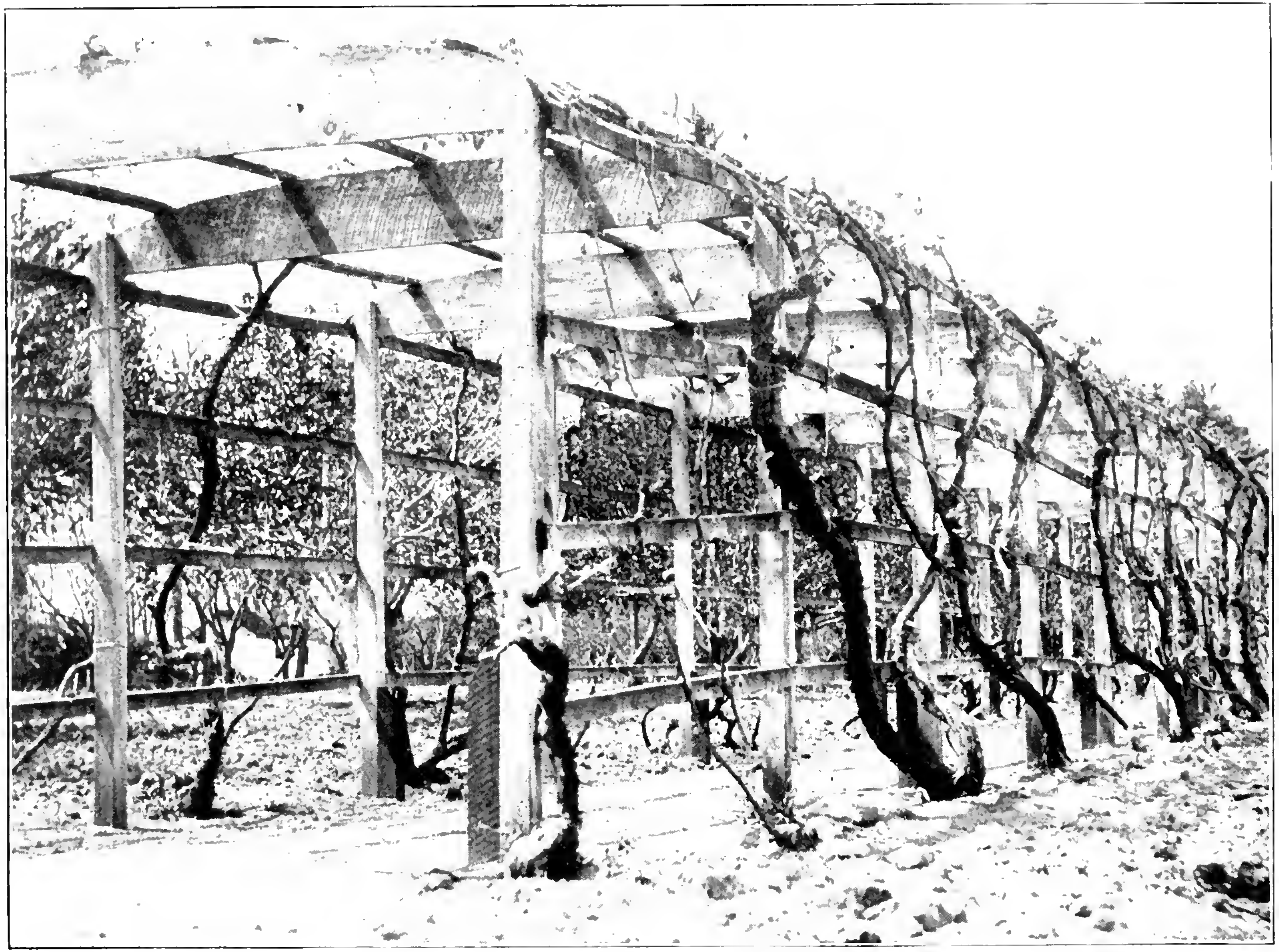


Grape arbor at Fresno, California.

PRUNING THE GRAPE.

PROF. U. P. HEDRICK.

Why prune grapes? Grapes are pruned to prevent over-bearing, to increase the size of bunch and berry, to maintain the vigor of the vines, and to keep them within proper bounds. A glance at the reasons for pruning shows that the operation has to do with the modification of the vigor and the fruitfulness of the plant, which is pruning proper, and with training, which aims to keep the vines in manageable size and shape. A man can care for his vines better if he keeps clearly in mind these quite distinct objects of pruning.

Whatever the method of pruning and training chosen, and as we shall see there are many, the grower must take in account the relationship of the wood to fruit-bearing. Grapes are produced on the base of the shoots of the same year, which in their turn spring from the canes of the preceding year. This important fact must be emphasized by an illustration. The average yield of a Concord grapevine is about 15 pounds; it requires from forty to sixty clusters of grapes to produce this quantity of fruit. As a shoot bears from two to three clusters, twenty to thirty buds must be left on the previous year's growth to furnish the required number of clusters. Therefore two, three or more canes are selected and are variously distributed on one or two main stems in accordance with the system of pruning. Good pruning, then, means removing all wood except canes or spurs sufficient to furnish the shoots necessary to produce the desired number of clusters of grapes.

Terms defined.

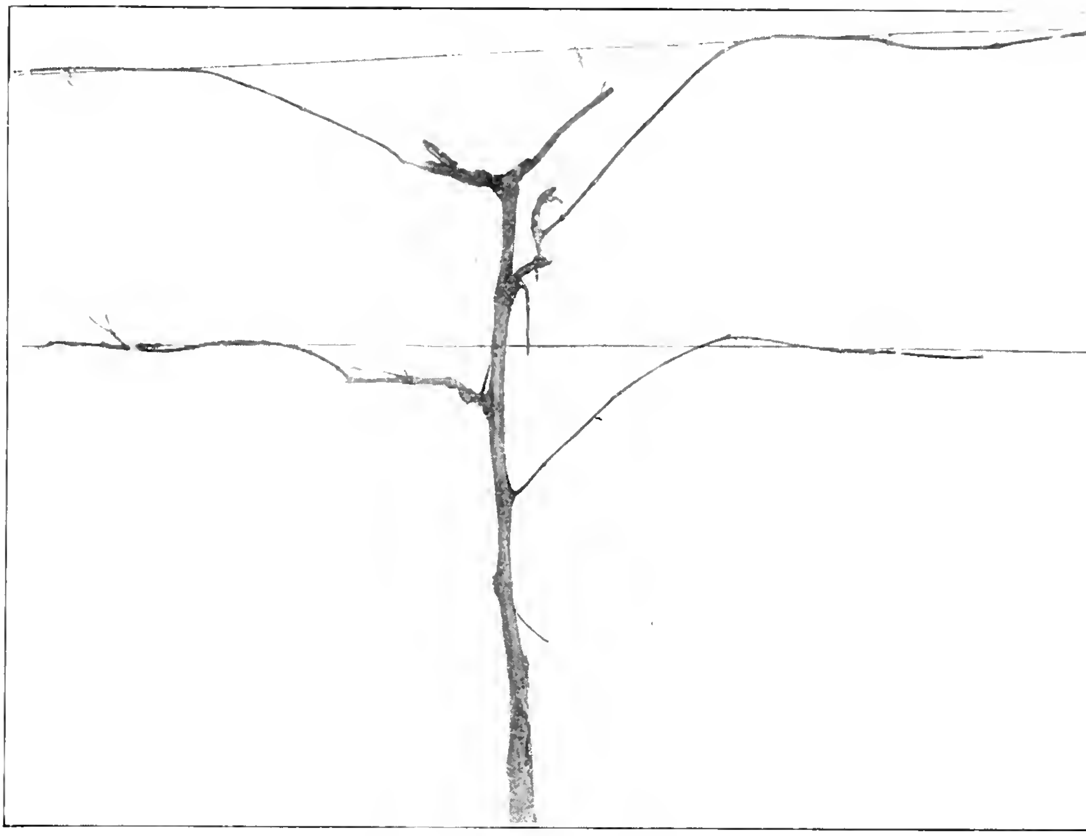
Before going further we must define several terms. The *trunk* is the body of the vine when two or more years old. An *arm* is a branch from the trunk, two or more years old. A *cane* is a one-year-old branch of the arm or trunk. A *spur* is a very short but annually lengthening arm from which cane renewals are made. A *shoot* is the growing, leafy branch of the current season.

Systems of Pruning.

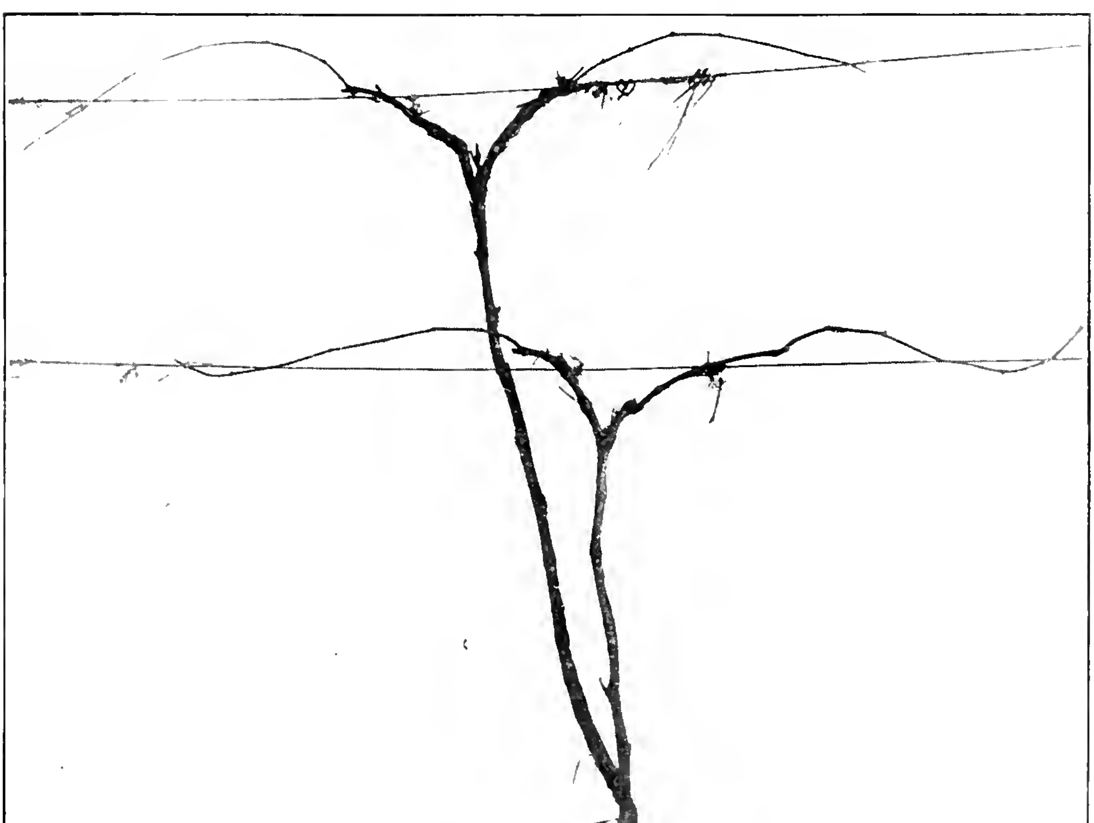
Grape growers designate distinct methods of pruning as "systems," of which there are a score or more, only a few of which need be described in this article. Before taking up the several systems it must be said that pruning to maintain vigor and promote fruitfulness is more essential than training in any particular way, though there necessarily exists a close relationship between pruning and training. Usually, it is true, a vineyard should be pruned and trained in accordance with one of the named systems, but very often lack of vigor in the vine will not permit the pruning necessary to train all vines in the vineyard in the desired way. Thus, in pruning and training the operator must be able to exercise good judgment. The vineyardist must decide how much pruning each individual vine in his vineyard is to receive, and according to what system his whole vineyard can be trained to the best advantage. When the vines are vigorous the system of training is largely optional with the grower, but if they lack vigor one is often forced to adopt a system which he might not otherwise choose. For example, strong-growing varieties, like Concord and Niagara, do best trained with the shoots drooping; whereas weak-growing sorts, as Delaware, are usually best trained with shoots upright.

Drooping System.

We come now to the discussion of the several systems, and may as well take up first those in which the shoots are allowed to droop and hang free, the drooping systems, which



Single-stem Kniffen system.



Two-stem Kniffen system.

have the advantage of being more economical, as no summer tying is necessary. A man named Kniffen was the originator of this method of training grapes, and his name is perpetuated in all of its many modifications now to be described.

Single-stem, Four-cane Kniffen System.

In this method of training, a single trunk is carried to the top wire of the trellis. This can be done in most vineyards the second or third year after setting. The top wire is at an average height of 5½ feet above the ground, the lower wire 2 feet lower. Four canes are taken from side spurs on the trunk and laid to right and left on each wire. The upper canes should be longer than the lower ones, as the vines are most vigorous at the extremity of the stem. The trunk is permanently tied to each wire. Pruning, then, consists of cutting out all but four of the canes that have developed from the canes of previous years, selecting the most vigorous and those that are closest to the main trunk, cutting them back to five or six buds and again tying up. Probably this is, the country over, the most generally used method of training grapes, its simplicity commending it in particular to the novice.

Two-stem, Four-cane Kniffen System.

This system is very similar to the one just described, the difference being that two permanent trunks are brought up from the ground, one to the lower wire and the other to the top wire, with two canes taken off from each. In using the two-stem method the canes taken off from each trunk may have the same number of buds, the two trunks being considered as distinct vines. This system is supposed to be particularly well adapted to strong-growing varieties on fertile soils.

Y-stem Kniffen System.

The Y-stem differs from the two-stem in that instead of the two stems being brought up from the ground, a branch is taken from the main stem a little below the lower wire from whence it is carried to the top wire and tied. The number of canes laid down and the subsequent treatment are the same as in the other systems so far described. This method, too, is used when vines are vigorous and the soil rich.

Umbrella Kniffen System.

In the umbrella Kniffen system two canes are used instead of four, each having from eight to twenty buds. The canes are taken from spurs on the trunk at the top wire. They are then tied to right and left for a distance along the upper wire after which they are bent down to the lower wire and secured. The clusters of grapes are supposed to be better protected from heat and sunscald by the umbrella method of training, and the method is used, therefore, in warm climates and with tender varieties in cold climates.

One-wire Kniffen System.

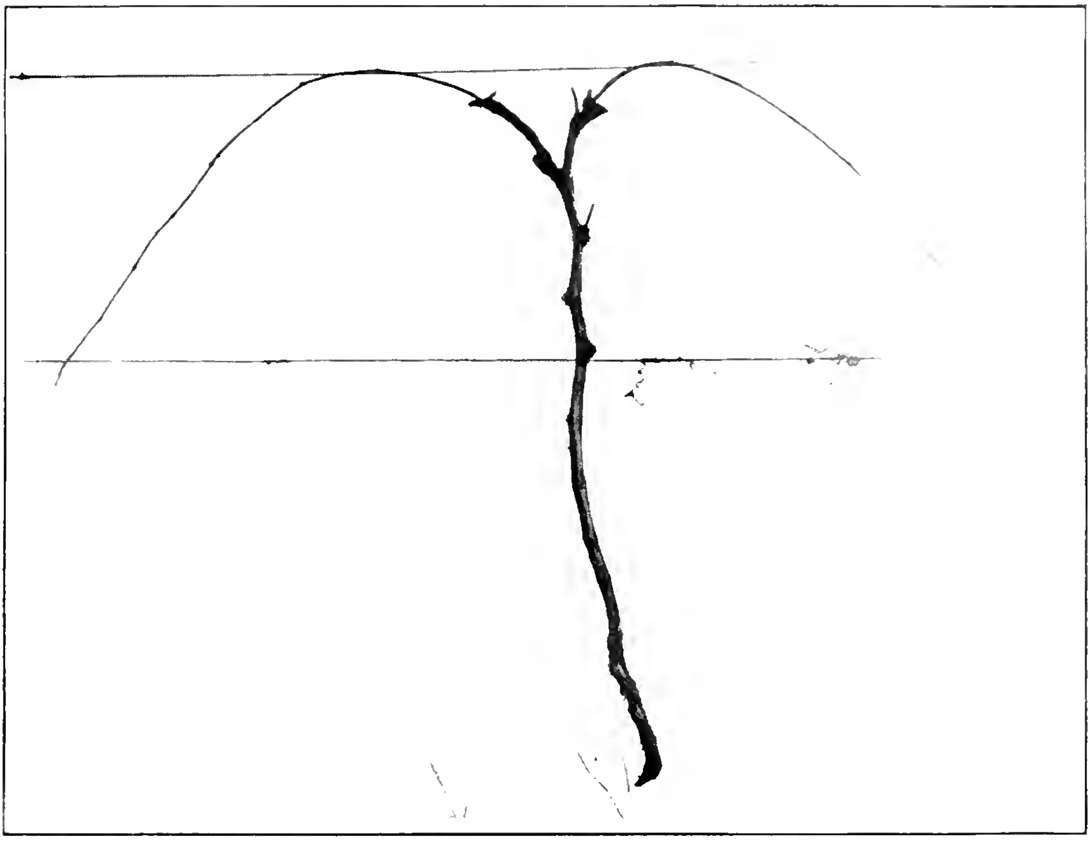
The one-wire Kniffen is a modification of the umbrella method, but differs in that the trellis has but one wire about 4 feet above the ground. The trunk is fastened to the wire and two canes of from ten to twelve buds are taken off and laid to right and left of the stem. The cheapness of the trellis commends this system to some growers.

Upright Systems.

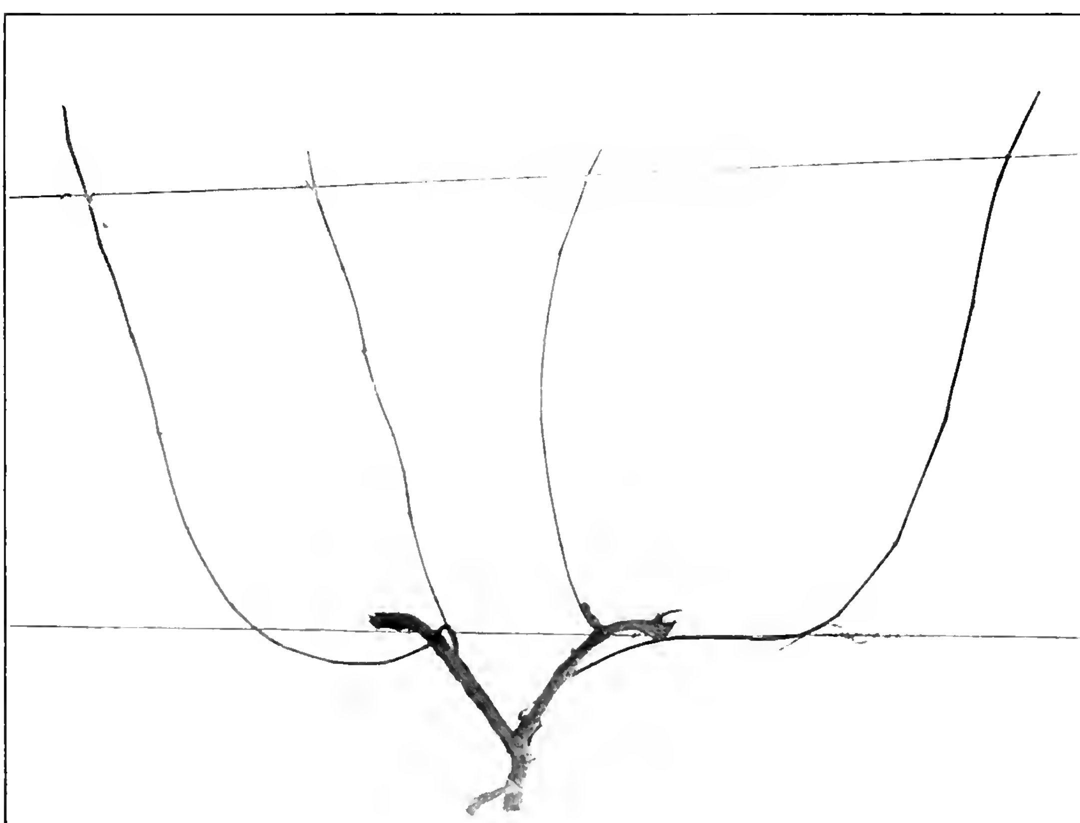
The upright systems are those in which two or more canes or arms are carried horizontally along the wires or obliquely across them, and the shoots as they develop are tied to wires above. Several upright systems, each with distinctive merits, are in vogue with grape growers.

The High Renewal System.

In this system the trellis is made with two or more, usually three, wires. The lower wire is placed from 18 to 30 inches above the ground, while the second and third wires are 20 inches apart. The trunk of the vine is carried to the first wire, and two canes each with from six to ten buds are taken off to right and left a little below the wire. The shoots that grow from the buds on these canes are tied to



Umbrella Kniffen system.



Chautauqua system.

the second wire and then to the third, as growth permits. Near the base of the canes, but upon older wood at the head of the stem, short spurs carrying two or three buds are maintained from which shoots develop to furnish the fruiting canes of the following year. In this method the amount of old wood retained is reduced to a minimum, but the labor of tying is greatly increased. Large quantity and high quality of fruit commend the method.

Spur Renewal; Horizontal-arm Spur System.

The trellis for this system is practically the same as for the high renewal. Two canes are laid down to right and left, as in the high renewal, but in this system these canes become permanent arms and do service for several years. The shoots that develop from buds on these canes the current year are cut back to two buds. Two shoots are allowed to go from each of these spurs and are tied to the upper wires. In the fall the cane developed from the upper bud of the spur is cut away and the other canes cut to two buds as before. At the beginning of the next season we have, as in the previous year, two shoots springing from a spur on these permanent arms. The spurs lengthen rapidly and become crooked, making it necessary to cut them away every few years and to grow others from shoots that arise on the arms. The spurs are developed from 5 to 20 inches apart. Formerly a favorite method of training, the " spur renewal " is now passing from practice.

Spur Renewal; Chautauqua System.

This system is a modification of the one just described much used in the great Chautauqua Belt in western New York. Permanent arms are used to support the shoots which, as they grow, are tied to the two or three wire trellis. The shoots may be tied obliquely or perpendicularly. If two wires are used they are placed about 34 inches apart; if three, about 20 inches apart. The canes for tying up the following year either develop directly from the old wood or arise from spurs on the arms, or from the best buds of the past season's canes. The old arms should be renewed at frequent intervals. Possibly the Concord and Niagara, under average conditions, are best trained either in this way or in the four-cane Kniffen system.

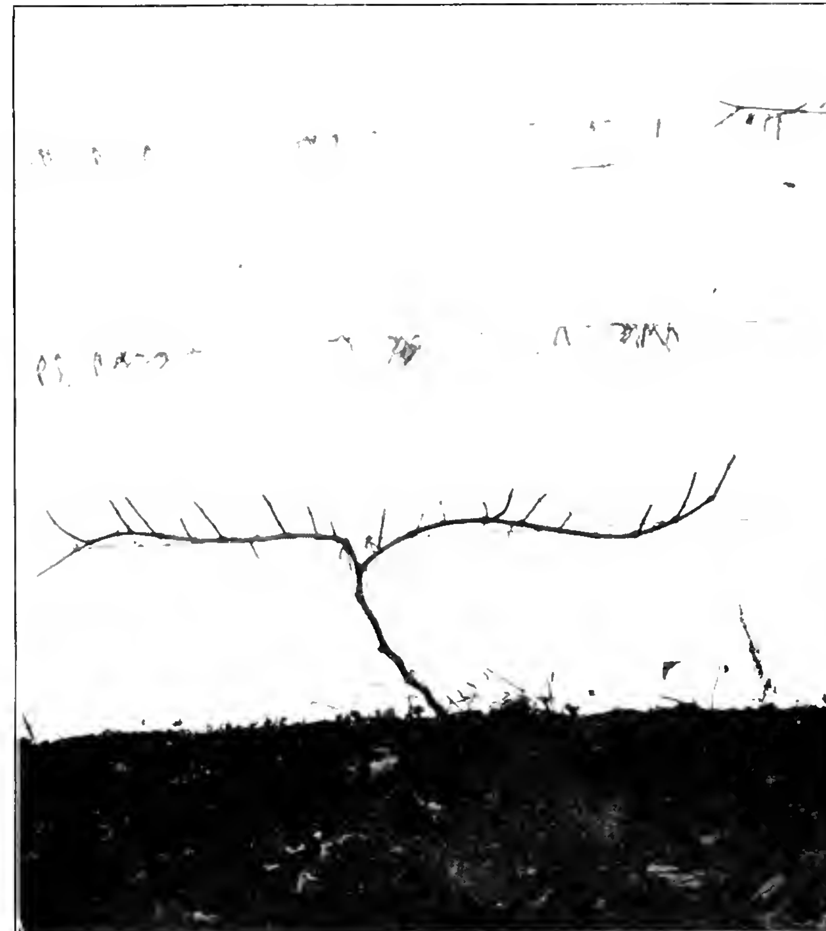
Arbors and Bowers.

But little skill is needed to train grapes as coverings for arbors and bowers. The permanent trunks are carried to the top or center of the arbor. From these trunks canes are laid out from year to year at intervals of about 24 inches, a feat possible only by leaving spurs for renewal. The vines should stand from 6 to 10 feet apart, and the canes are cut at half the distance between the vines, meeting in the middle of the dividing space. Shoots springing from these canes cover the arbor. The object in this sort of training is to secure shade, and it is not to be expected that fine grapes can be so grown, but if the vines are severely cut back from year to year, grapes of very fair quality and in considerable quantity may be produced.

Pruning Neglected Vines.

Many times it becomes desirable to prune neglected vines. Occasionally one finds a vineyard several years old that has never been pruned. In either case such vines can seldom be made over advantageously. If they are healthy and vigorous the best thing to do is to grow a new vine from a cane taken out from the root. The old trunk in such a case is allowed to remain until the new one is strong enough to be tied to the wires. To encourage the production of a new cane from the roots, and to induce vigorous growth in the new trunk, the old vine should be heavily cut back. If the new cane is exceptionally strong it can be tied to the wires at the end of the first season. More often it should be cut back in the winter to about three buds, from one of which the permanent trunk can be grown the second season. The new trunk is tied as if it were a young vine. Suckers are bound to arise under such treatment, and these should be removed frequently.

Horizontal-arm spur system, — before pruning.



Horizontal-arm spur system, — after pruning.

Time to prune.

Grapes may be pruned from the dropping of the leaves in the fall to the swelling of the buds in the spring. Pruning after sap begins to flow is devitalizing. It is seldom advisable to prune when vines are frozen, as the brittle canes are easily broken during handling.

Summer pruning is far less practiced now than formerly, with a tendency to do less and less of it. It is used to remove surplus shoots and in heading back canes to keep them within limits. Very often shoots grow from weak buds on the fruiting canes to the detriment of the fruit-bearing shoots. These weaklings should be rubbed off. So, too, shoots often break from arms, spurs or even the trunk where they are not wanted. These should be removed. Secondary shoots sometimes appear on fruiting shoots, especially in the axils of the latter; these should be rubbed off. Here, for the most part, summer pruning should end.

Tying.

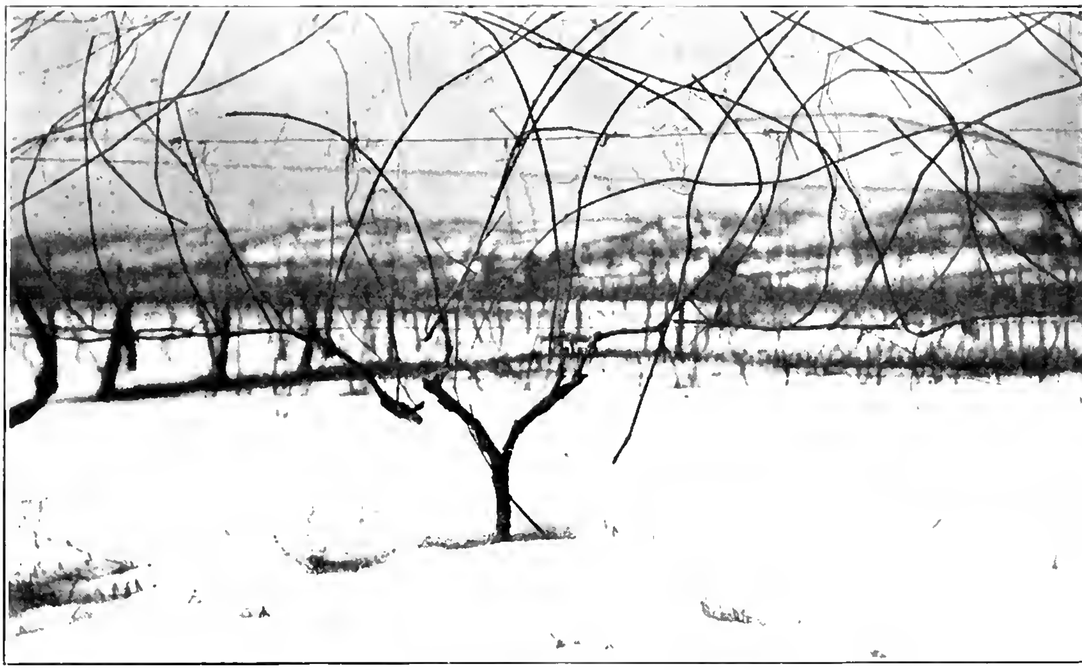
Tying the canes and shoots to the trellis is a task requiring quickness, skill and good judgment. Canes are tied before buds swell in the spring, and the shoots must be tied during the summer. The materials used in tying are various, such as raffia, wool twine, wire, willow, carpet rags, green rye straw, corn husks and bass wood bark. The canes should be tied to the windward side of the wire, and this tie is now almost always made with a No. 18 gauge, annealed wire about 4 inches in length. The tie is a double loop about wire and cane made by the workman standing on the opposite side of the wire from the cane. The wire should be soft, but even then the work must be done with mittens or gloves. The cane is bound snugly to the trellis that there may be no chafing. Shoots are best tied with raffia or wool twine, the tie being made very loosely to permit growth in the diameter of the shoot.

Odds and Ends of Pruning.

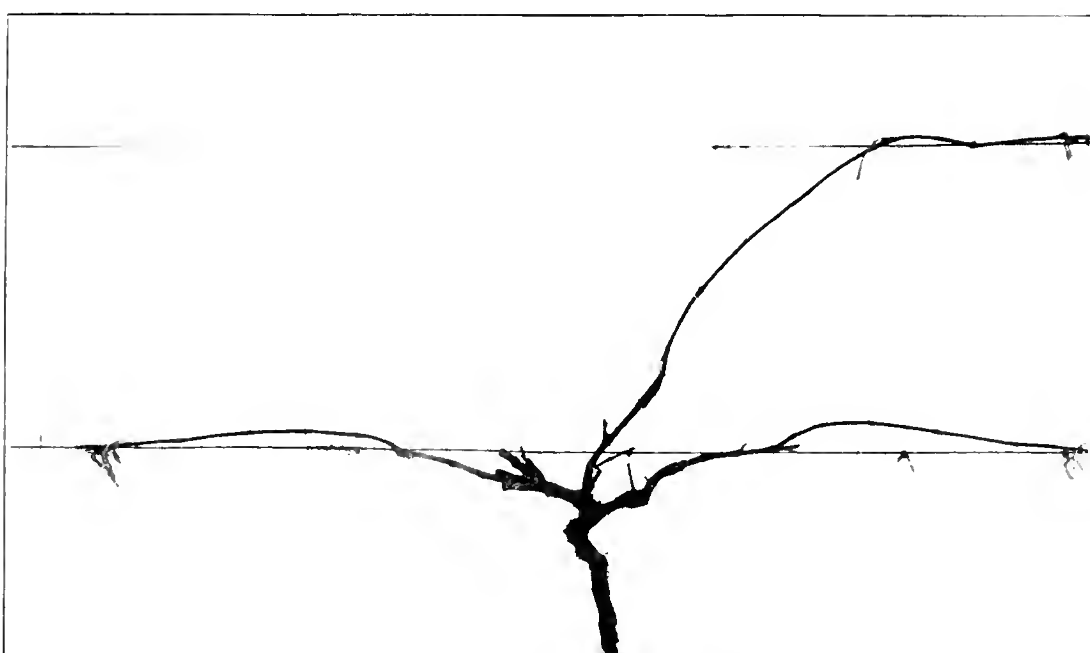
Grapes are best pruned with small, light, specially made pruning shears. Usually the canes are allowed to remain tied to the wires or stakes until the pruning is done, though in the Kniffen systems the strings may be cut. The work of pruning is best done by a skilled man who only makes the cuts or "blocks out." After the vineyard is "blocked out" the wires must be stripped. Stripping is usually done by unskilled labor. The prunings are hauled from the vineyard by a horse attached to any one of several devices, probably the best of which is a pole a little smaller than the pole used to bind a load of hay. A horse is hitched to the pole by means of a rope drawn through a hole about 4 feet from the large end of the pole. The small end is held in the hand as the butt is pulled along the ground. After the first vines are caught, the rest of the brush clings to the wood until a load is secured. Stripping and hauling must be done before the buds swell in the spring, otherwise many young buds will be broken off by pruned vines.

The Trellis.

Posts for the trellis are best made of chestnut or locust. They should be from 6 to 8 feet in length, reserving the heaviest for end posts. One post to every three vines is sufficient. The end posts are driven to a depth of from 22 to 23 inches and braced by a 2 by 4 or 4 by 4, notched to fit the post half-way from the ground to the top and standing obliquely to the ground where it is held by a 4 by 4 stake. Posts other than those at the end can if properly sharpened be driven into holes made with a crowbar. The best wire for the trellis is No. 9 or No. 10, the number and height of wires depending upon the vigor of the vines and the system of training. The wire is best secured to the end post by winding it once around the post and then around itself several times. Ordinary fence staples suffice to hold the wires on the posts, enough space being left in the staple to permit loosening and tightening.



High-renewal system. Pruned but not stripped.



High-renewal system. Pruned and stripped.

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Poultry Feeds and Methods of Feeding.

By J. C. GRAHAM.

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POULTRY FEEDS AND METHODS OF FEEDING.[1]

JOHN C. GRAHAM, PROFESSOR OF POULTRY HUSBANDRY, MASSACHUSETTS AGRICULTURAL COLLEGE.

It is impossible to discuss intelligently the subjects of feeds and feeding, from both a practical and scientific point of view, without thoroughly understanding a number of important terms now in quite common use. We can hardly pick up a poultry journal or a book on this subject without coming in contact with such terms as protein, carbohydrates, fats, nutritive ratio, balanced ration, etc. As there may be some readers who are not familiar with these terms, they will be defined in order that the discussions which follow may be fully understood.

Proteins are made up of the nitrogenous portions of feeds. They are the body builders, used in making the lean meat, eggs, hair, nerves, tendons, etc.

Carbohydrates are the starches and sugars particularly. These are used for energy and heat. A hen may eat a large amount of carbohydrates in twenty-four hours and yet at the end of the time, if she were killed and her flesh analyzed, we would find not more than one per cent of carbohydrates in her body, although her food has been composed largely of these materials. It shows how completely these are changed into other things.

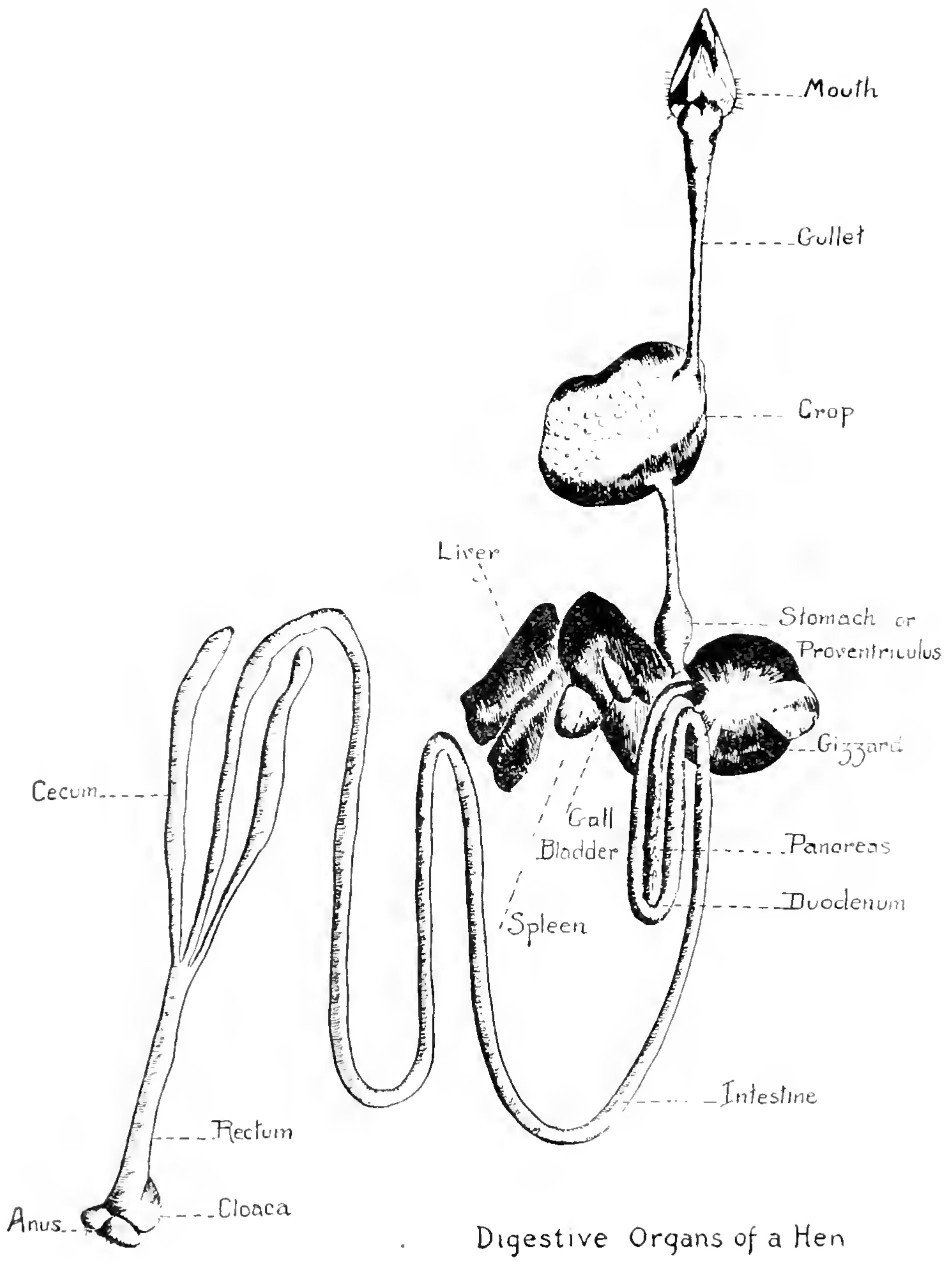
Fats are the oily portions of food; they are also used in the body for heat and energy. The important thing about them is that they are worth for that purpose two and one-fourth times as much as the same weight of carbohydrates. That is, one pound of fats will produce as much heat and energy as two and one-fourth pounds of carbohydrates.

A balanced ration is one in which the amounts of protein, carbohydrates, fats and ash are in such proportions that when it is eaten by the hen there will be no waste of any one of these components.

[1] From "Agriculture of Massachusetts," 1913.

Food principles, or food compounds, include protein. carbohydrates and fats.

The nutritive ratio is the ratio between the amount of digestible crude protein and the carbohydrates and fats in any given feed. It is found by multiplying the amount of digestible



Digestive Organs of a Hen

fats by $2\frac{1}{4}$, adding it to the digestible carbohydrates and dividing the sum by the amount of digestible protein.

We should also have some knowledge of the digestive apparatus of the hen if we wish to thoroughly understand her needs. This plate represents the digestive organs extending from the head to the vent. They were removed from the hen a few weeks ago, placed in the position that we see them here and drawn. This plate does not show the relative position of the organs in the body, but it does represent their relative size. What is known as the gullet extends from the mouth to the crop, which is a reservoir for holding the food until it is softened more or less by the secretions of the mouth and of the crop itself. The crop is not the true stomach of the fowl, as many suppose. The true stomach is an enlargement of what might be termed the continuation of the gullet from the crop to the gizzard. Another term for it is the proventriculus. On opening it we find that its walls are quite thick and muscular, and lined with gastric glands similar to those in the lining of the human stomach. The gizzard is an irregularly shaped organ, the largest in the body, and has thick muscular walls of a very fine grain and of a bluish, dark red color. Partially enfolding the gizzard we find the liver, composed of two very large lobes. Attached to it is the gall bladder, where the bile is stored. Near it also is the spleen, an organ whose use we do not thoroughly understand, although some scientists believe it has some relation to digestion, as it is not found in the same condition just before and after meals.

The pancreas is the long, flat, pinkish organ lying close to the upper end of the intestines, or what is termed the duodenum. This secretes pancreatic juice. The intestines extend from the gizzard to the anus, about six or seven inches from which we find two blind sacks, called the ceca. They are sometimes spoken of as the "blind guts," and correspond to the appendix in man, but are double in the fowl. In diagnosing black head in turkeys, or coccidiosis as it is known in fowls, we find the ceca greatly enlarged, and many times their lining is eaten off, or they may be filled with a hard, cheesy substance. These organs seem to be the habitat for many intestinal worms, and if one is making a diagnosis for coccidiosis, or worms, he would naturally examine the ceca first. The part of the intestines extending from the ceca to the anus is called the rectum. The enlargement of the intestine just forward of the vent is called the cloaca. It is a reservoir where the fæces gather before being expelled from the body. The urinal duct opening into this reservoir is a very important factor in studying the digestibility of feeds in poultry. The fact that the urine and the faeces mix before being expelled makes it very difficult to study the digestion of protein, particularly because in the faeces we find the undigested portions of the feed and in the urine the nitrogenous materials that come from the broken-down cells of the body. As these mix before being expelled, it is very hard to determine how much of the nitrogen comes from the indigestible portions of the feed and how much from the urine. The entire length of the digestive apparatus of the hen is about five feet, varying somewhat in different individuals. Some think that there is a relation between its length and egg production, but more data will be needed to verify this theory.

The process of digestion is somewhat as follows: the food is swallowed by the hen and remains in the crop for a time to be softened. It then passes into the stomach, where it is mixed with gastric juice which acts upon certain portions of the food. From here it passes into the gizzard, where it is ground and thoroughly mixed with the gastric juice already mentioned. It then leaves the gizzard by way of the intestines, where it is mixed with bile from the liver and pancreatic juice from the pancreas. These are very powerful digestive juices, and most of the food is accordingly digested in the duodenum, or the first twelve to eighteen inches of the intestines; but there is also an intestinal juice secreted by the lining of the intestines that acts upon the undigested portions of the food and completes digestion. The digestive apparatus of the goose or the duck differs from that of the hen in that there is no crop. The feed they eat remains in the gullet, which becomes more or less distended, until it passes through the stomach to the gizzard. This difference is probably due to the early habits of the birds. The geese and ducks, being water fowl, were able to eat food almost continually, whereas the original hen found it necessary to store up her food on account of her wandering habits. A thorough understanding of this subject will help us in the consideration of much of the data that will follow.

In our original studies of feeds and food principles, very little attention was paid to the value of the ash, or the mineral portions of feeds. It was thought that if we fed the right proportions of protein, carbohydrates and fats we were meeting all the requirements of the animal. However, more recent investigations and experiences have shown that many times animals do not do well because the food lacks mineral matter. Certain animals have been fed on ash-free food, and it was found that within a few days a decided change took place; the animal became weak, was unable to eat sufficient food, and if the experiment was continued for a few weeks it died.

In studying the needs of various classes of animals, naturally the milk of the mother formed the basis for investigation.

TABLE 1.—*Showing the Importance of Ash, Protein and P_2O_5 in the Feed for Growing Stock.*

	Days.	Lime.	P_2O_5	Ash.	Protein.	Sugar.
Woman,	180	.03	.05	2	1.5	6.8
Mare, .	60	12	.13	4	1.8	6.8
Cow, .	47	16	.20	7	3.4	4.7
Ewe, .	15	.25	.29	.8	6.7	4.2
Sow, .	14	25	31	8	7.2	4.5
Rabbit,	6	89	.99	2.5	15.5	2.0

The foregoing is a very interesting chart on the analysis of milk of various animals. The first column gives the name of the mother. The second, the number of days after birth required for the young to double its weight. For example, the baby usually doubles its weight in one hundred and eighty days, the colt in sixty days, the calf in forty-seven days, and so on until we reach the rabbit, which doubles its weight in about six days. The third column gives the amount of lime in the milk of the mother. Notice that the amount of lime in the milk of these animals is inversely proportioned to the number of days required by the young to double their weight. The amount of lime in human milk, for instance, is one-thirtieth of that in the rabbit's milk; while the time required for the baby to double its weight is just thirty times greater than that for the rabbit.

Note that there are about equal amounts of lime and phosphoric acid in the milk of each, plenty of this material being provided.

In the next column we note the amount of protein in the milk of these various animals. We find the relative proportions are about the same as that of ash. The last column shows the amount of sugar in the milk. This is in inverse ratio to that of ash and protein, *i.e.*, we find more sugar in human milk and in the mare's milk than we do in that of the rabbit or sow. About the only way we can explain this difference is the fact that the rapid-growing animals, or those that double their weight in a very few days, need a large amount of ash for the framework and also a large amount of protein for building the tissues, whereas the sugar is needed principally for heat and energy, and is not so essential to the growth of the quick-growing animal as the other two, because protein, in case of necessity, can also be used for heat and energy.

As the chick doubles its weight in about twelve days under normal growth, it would come somewhere between the young rabbit and the pig. It therefore needs a large amount of ash and protein in its food.

It may seem to many unnecessary to dwell so long upon a matter of this kind, but there are hundreds of people who give their little chicks nothing but bread and cracked grain, or foods containing no more ash than these. The following chart illustrates the comparative ability of poultry and ruminants to digest some of our common grains: —

TABLE 2.—*Digestibility of Feeds.—Comparison of Hen with Ruminants.*

NAME OF FEED.	PROTEIN.		NITROGEN FREE EXTRACT.		FATS.	
	Hen.	Ruminant.	Hen.	Ruminant.	Hen.	Ruminant.
Bran,	71.7	77	46.0	71	37.0	63
Beef scrap,	92.6	–	–	–	95.0	–
Barley,	77.0	70	85.0	92	67.8	89
Corn,	81.5	76	91.3	93	88.0	86
Oats,	71.3	77	90.0	77	87.8	89
Wheat,	75.0	74	87.0	93	53.0	71

Very little experimental work has been done with poultry on this subject, not because it is not important, but because of the physiological difficulty already mentioned, arising from the fact that the fæces and urine unite in the cloaca before being voided, which makes it very hard, indeed, to use poultry for digestion studies with satisfactory results. However, there are a few men who have attempted work along this line, and we think with considerable success. Among these are Dr. Woods of the Maine station, who obtained the results above shown. He used capons because of their inactive habits, and caught the fæces in a rubber bag attached to them with a sort of harness. His work shows that fowls are able to digest protein almost as well as cows can. Note how well they handle beef scrap and corn, but do only fairly well with oats, barley and wheat, and very poorly with bran.

TABLE 3.—*Digestibility of Feeds.—Comparison of Hen with Ruminants.*

NAME OF FEED.	PROTEIN.		NITROGEN FREE EXTRACT.		FATS.		FIBER.	
	Ruminant.	Hen.	Ruminant.	Hen.	Ruminant.	Hen.	Ruminant.	Hen.
Peas,	83	90.3	94	91.6	55	83.7	64	13.74
Buckwheat,	75	59.4	76	87.0	100	89.2	94	2.02
Wheat,	74	56.9	93	93.3	71	55.2	–	29.95
Barley,	85	79.2	86	89.1	87	68.3	50	–

Here is another table giving data which have been taken from a European experiment. It shows that the hen can digest peas better than ruminants can. If this is reliable, there is no reason why cracked peas and pea meal should not form a part of the ration for fowls. Note also that they cannot digest the protein in our common grains as well as that contained in beef scrap, as shown in the preceding table.

The data given on the digestion of fiber afford very good evidence that the hen cannot digest this material as well as our other farm animals can. It is found, for instance, that the ruminants digest 94 per cent of the fiber in buckwheat, and the hen only about 2 per cent. Also the fiber in peas is hard for her to digest, notwithstanding the fact that she digests the other ingredients in them very well indeed.

TABLE 4.—*Digestibility of Fiber.—Comparison of Hen with Ruminants and Horse.*

Name of Feed.	Fiber.		
	Hen.	Ruminant.	Horse.
Rye,	2.4	-	31
Oats,	.5	31	35
Barley,	.2	50	-

This is a chart comparing the digestion of fiber by the hen with that of ruminants and the horse. The data here are very similar to those given in regard to buckwheat and peas. Only about .5 of 1 per cent of the fiber in oats is digested by the hen, whereas from 30 to 35 per cent of it is digested by the horse and ruminants. And barley, another grain similar to oats, being covered with an indigestible husk, is very hard for hens to digest also. Only .2 of 1 per cent of the fiber is digested by the hen, while 50 per cent is digested by ruminants.

It appears from these various studies that, while the hen can handle carbohydrates in our common grains very well, the proteins and fats in them are digested only fairly well; and that while she can digest the protein in our animal products very well indeed, she is unable to digest very much fiber.

Therefore, in feeding, we should be careful not to overload our mashes, or rations, with so much of this fiber-laden material that the hen's digestive powers will be overtaxed.

TABLE 5.—*Amount of Droppings voided relative to Time of feeding Wet Mash.*

Dates.	Number of Days' Droppings.	Morning Mash.		Evening Mash.	
		Number of Hen Nights.	Weight of Droppings (Pounds).	Number of Hen Nights.	Weight of Droppings (Pounds).
March 3,	1	22	3.00	21	6.00
March 5,	2	44	5.25	42	11.00
March 7,	2	44	5.25	42	10.50
March 10,	1	22	2.50	21	6.25
March 21,	1	22	2.50	19	4.50

The data of this chart were taken from bulletin 122 of our own station, published a number of years ago but now out of print. This is the result of an experiment carried on by Dr. Brooks, and its object was to determine the difference in weight of droppings voided by hens fed at night on a wet mash and on a whole grain ration. The first column shows the dates; the second, the number of days' droppings gathered; the third, the number of hens on the roost, or, as the chart puts it, the number of hen nights, *i.e.*, on March 5 the droppings were left for two days, so the number of hens were doubled to give the number of hen nights. In the fourth column we find the weight of the droppings. Columns 5 and 6 contain data similar to those of 3 and 4, except that the hens in those pens were fed a wet mash in the evening, whereas the data in columns 3 and 4 are from pens containing hens fed mash in the morning and whole grains at night. It is seen that the weight of the droppings from birds fed wet mash in the morning is only about one-half of that from hens fed wet mash at night. This, it seems to me, is quite conclusive evidence that our ground grains, or mashes, are more quickly digested than the whole grains. This fact has considerable bearing upon the proportion of scratch feeds and mash to be fed to hens we wish to force. A forcing ration should consist of at least half ground grains by weight. If we want to make our ration still more forcing we should cause our hens to eat a still greater proportion of the ground grains.

The following chart shows the value of skim milk as a food, and its data were supplied by an experiment carried on at the Wisconsin Agricultural Experiment Station a few years ago. A sow weighing 23 pounds was placed in a pen in the month of May, where she could get nothing to eat except what was given her. She was fed wholly on skim milk for one year, at the end of which time she weighed about 406 pounds, and produced 10 pigs, the total weight of which at birth was 23 pounds. The sow and pigs were continued on the same ration, and when the latter were six weeks old they averaged 18.6 pounds apiece. We know of no experiment that has ever been carried on that shows more conclusively the value of skim milk as a food. It should be used for poultry when obtainable at 25 to 30 cents per hundred pounds. Better results will follow if it is soured before feeding, as the increased amount of lactic acid aids digestion.

TABLE 6. — *Value of Skim Milk as a Food for Animals.*

	Pounds.
Weight at beginning of experiment,	23.0
Weight one year later,	406.0
Weight of 10 pigs produced,	23.0
Average weight of pigs at six weeks of age.	18.6

CONCENTRATED FEEDS.

Just as concentrates have enabled the dairyman to develop the modern cow, so they have enabled us to develop the hen into the modern egg machine. Were we to feed poultry as it was done forty or fifty years ago, we would not get any more eggs than were produced then. At that time, on many farms, hens were not expected to lay except during the spring and early summer. The reason they laid in the spring so well was because of the green feed, worms, bugs, etc., that they were able to pick up. But concentrates, such as meat meal, gluten feed, oil meal, etc., have enabled us to feed the hen on rich protein foods throughout the year, and consequently we have the 200-egg hen.

In the great corn-growing section of the country the principal grain fed to poultry has naturally been corn, and because the use of corn as the entire ration for hens during the winter months resulted in a low egg production, it came into disrepute as a poultry feed, in spite of its actual good qualities. This caused both the Geneva Station, New York, and our own station to conduct a series of experiments on the value of corn for poultry, with the result of showing that properly used it is a most excellent feed.

Table 7. — *Feeding Values of Various Foodstuffs compared with Corn.*

Name of Feed.	Heat and Energy (Per Cent).	Value.	Price.
Corn meal,	100	$1 75	$1 75
Oats (ground),	83	1 45	1 85
Wheat,	92	1 61	2 00
Wheat middlings (flour),	98	1 71	1 65
Wheat middlings (standard),	67	1 17	1 55
Wheat bran,	57	99	1 45
Linseed meal,	94	1 64	1 75
Hominy meal,	105	1 82	1 65
Gluten meal,	91	1 59	1 70
Corn silage,	12	21	–

This chart gives data worked out in part by Dr. J. B. Lindsey, of the Massachusetts Agricultural Experiment Station. The second column gives the heat and energy value of the various feeds or grains named in column 1, with corn meal taken as a standard; not, however, including the value of the protein in the grains for body building. Oats, it appears, are worth only 83 per cent and wheat 92 per cent as much as corn in producing heat and energy. Flour middlings as a heat producer almost equals corn, but standard middlings, which sell at only 10 cents per hundred less, are worth only about two-thirds as much as corn meal, yet many times during the year we pay more for standard middlings than for corn meal. Wheat bran, we find, is worth a little more than half as much as corn meal in producing heat and energy, yet we pay a great deal more for it at most seasons of the year. Hominy meal, which can be bought on the market most of the time, is, as a heat and energy producer, worth more than corn meal for feeding. The third column shows the actual value of these various feeds as compared with corn, and the last column shows the price paid for them this fall, about the middle of October. At that time we were paying $1.75 per hundred for corn meal and $1.85 per hundred for ground oats, yet the value of corn meal was 30 cents a hundred more than that of oats. We also paid $2 per hundred for wheat, but its actual feeding value compared with corn, as far as heat and energy are concerned, was 14 cents a hundred less. In the case of wheat middlings we find the value greater than the price paid by about 6 cents. Standard middlings and bran, according to these data, are worth very much less than we pay for them. Linseed meal was worth $1.75 per hundred at that time, and its heat and energy value was $1.64, but this particular feed contains a great deal of protein, the excess value of which, added to the $1.64, would make this a very economical feed.

The feed, giving the best returns for our money, as shown by the table, is hominy meal, which could have been bought at that time for $1.65 per hundred, and its actual feeding value, compared with corn at $1.75, is $1.82. Notwithstanding the high price of corn at the present time, we should use it liberally in our ration, both in the mash and in the scratch feed. We also found in our digestion tables that corn was digested very well indeed by hens. Taking these two things into consideration, it is the very best grain we have for poultry. We should feed sparingly of standard middlings and wheat bran, although we use bran not so much for its food value as to lighten up the ration, and keep the food from packing in the crop.

TABLE 8. — *Rations for Heavy Laying Hens. — Digestible Nutrients needed per Day for Each 100 Pounds Live Weight.*

	Dry Matter (Pounds).	Ash (Pounds).	Protein (Pounds).	Carbohydrates (Pounds).	Fats (Pounds).	Fuel Value (Calories).	Nutritive Ratio.
Hens, 5 to 8 pounds,	3.30	.20	.65	2.25	.20	6,240	1:4.2
Hens, 3 to 5 pounds,	5 50	.30	1 00	3.75	.35	10,300	1:4.6

This is one of the most interesting and valuable tables that has ever been worked out on the subject of poultry feeding. It is well known among experienced and well-informed poultrymen that a balanced ration for hens should have a nutritive ratio or about 1 to 4½. Just how that was worked out may be interesting to many. Dr. H. J. Wheeler, formerly of the Geneva Experiment Station, performed an experiment to determine this along with some other facts, and secured these data.

Note that he worked with birds varying in size. Two pens contained hens weighing from 5 to 8 pounds, and two, hens weighing from 3 to 5 pounds. This table shows the amount of food each lot consumed per day for each 100 pounds of live weight. The experiment ran for a number of months, and what we have here is the average. The ratio between the amount of food consumed per day by the hens weighing from 5 to 8 pounds, as compared with those weighing from 3 to 5 pounds, is about the same for each of the food principles. One interesting fact brought out is that the small hens consumed nearly twice as much per 100 pounds of live weight as the larger hens. This is due undoubtedly to the larger number of eggs laid by the small hens, weight for weight, as there were perhaps 24 or 25 hens in the one pen and 15 or 16 in the other.

Another interesting fact is the ratio between the amount of ash and protein in the food consumed, which is about 1 to 3. This is doubly interesting because there is one particular mash on the market to-day that contains nearly twice as much ash as protein. It seems to me that poultrymen should think twice before they buy a mash that is loaded up so heavily with mineral matter.

But the main point in regard to these data is that the conclusion here reached, that the nutritive ratio of a balanced ration for a hen is about 1 to 4½, forms the basis for compounding our rations at the present time.

On account of many letters received asking information regarding the value of sprouted oats as a poultry food, we concluded to make an analysis of whole oats and of sprouted oats, to see whether there was a loss or gain through sprouting. A sample of whole oats was taken, and another sample from the same lot was sprouted in the usual way. When the sprouts were 1½ inches long a sample was analyzed and compared with the analysis of the original sample. The comparison is shown in this chart.

TABLE 9. — *Analysis of Whole Oats and Sprouted Oats (Per Cent).*

NAME OF INGREDIENT.	Whole Oats.	Sprouted Oats.
Protein,	15.05	15.24
Albuminoids,	13.81	12.22
Amides,	1.24	3.02
Fat,	8.80	8.91
Nitrogen free extract,	62.50	60.49
Fiber,	10.36	12.31
Ash,	3.29	3.05
Soluble sugars (dextrose),	1.33	5.78

It can be seen that the sprouting of these oats made very little difference in their nutritive value. There was a slight decrease in the amount of ash and a very perceptible increase in the amount of soluble sugars, *i.e.,* some of the starch in the oats was changed to sugar in the form of dextrose. That sprouted oats are very palatable is a well-known fact among poultrymen, and the changing of some of the starch to sugar no doubt accounts for this. We conclude, therefore, that the sprouting of oats does not decrease their actual nutritive value, and that we gain considerable in palatability and also in having a green food.[1]

[1] Mr. Philip H. Smith, of the Massachusetts Agricultural Experiment Station, performed the chemical analysis.

There has been upon the market for the last few years a certain grit known as Hen-e-ta, for which great claims have been made by the company putting it out. In one of their circulars a statement was made that the eggs from hens fed Hen-e-ta contain twice as much phosphoric acid as ordinary eggs, and, therefore, hatch better. We decided to feed a lot of hens on oyster shell and another lot on Hen-e-ta, in order to test the claim by analyzing the eggs. Two pens of White Leghorns were selected and fed for about six weeks, one on oyster shell and the other on Hen-e-ta. In other respects their feed was the same. At the end of the period six eggs were selected from each pen and analyzed, with the following results: —

TABLE 10. — *Analysis of Eggs.*

	Per Cent of Phosphoric Acid (P_2O_5).	
	Oyster-shell Eggs.	Hen-e-ta Eggs.
Egg shells,	.33	.33
Whites of eggs,	.32	.27
Yolks of eggs,	2.77	2.81

It would appear from this analysis that the whites of the eggs from the oyster-shell pen contained slightly more phosphoric acid than those from the Hen-e-ta pen, whereas the yolks of the eggs from the Hen-e-ta pen contained slightly more phosphoric acid than those from the oyster-shell pen. This slight apparent difference evidently lies within the radius of experimental error, so our conclusion naturally is that the feeding of Hen-e-ta rather than oyster shell makes no difference in the amount of phosphoric acid in the eggs.[1]

It would be much more convenient for the average poultryman were we to compound our rations on the basis of measure rather than of weight, because many poultry keepers either do not buy a large quantity of feed at a time, or, even though they do, they may not mix it all at the same time; many of

[1] Mr. H. D. Haskins, of the Massachusetts Agricultural Experiment Station, performed the chemical analysis.

them have no scales suitable for weighing grain, and are, therefore, obliged to measure out the different ingredients, and guess at the amounts corresponding to the weights desired. Especially is this true of the smaller poultry keepers. The reasons, however, why we base the amounts upon weight rather than measure in compounding rations are that all feeds, as a rule, are bought by weight, and also that measuring cannot be done accurately enough for scientific work. The following table is intended to aid those who find it convenient to compound their feeds by measure: —

TABLE 11. — *Equivalents of Weights and Measures.*

NAME OF FEED.	Quart.	Pound.	Pound.	Quart.
Alfalfa meal,	1	1.0	1	1.0
Corn, whole,	1	1.7	1	.6
Corn meal,	1	1.5	1	.7
Gluten feed,	1	1.3	1	.8
Linseed meal,	1	1.1	1	.9
Oats, whole,	1	1.0	1	1.0
Oats, ground,	1	.7	1	1.4
Wheat,	1	1.9	1	.5
Wheat bran,	1	.5	1	2.0
Wheat middlings,	1	1.2	1	.8

This chart, showing the equivalents of weights and measures of our most common poultry feeds, was prepared by Dr. Lindsey, with the exception of a very few items. The second column, giving the equivalents of 1 pound in terms of quarts, is the column that is of especial interest to the poultrymen who wish to do their mixing by measure. It, of course, makes no difference whether you use a quart measure, a peck measure, a bushel measure or a box, providing you use the same in measuring all of the ingredients. The table shows that if you wish, for example, to make a mixture containing equal parts by weight of corn meal, gluten feed, ground oats, wheat bran and wheat middlings, you will take about ¾ quart of corn meal, ¾ quart or a little more of gluten feed, nearly 1½ quarts of ground oats, 2 quarts of wheat bran and ¾ quart or a little more of wheat middlings, in order to get the proper proportions by weight. In the same way one can make various mixtures by using the proper measure for each, and yet have the result based on weights.

TABLE 12.—*Chemical Components of Poultry, Eggs and Corn (Per Cent).*

	Water.	Ash.	Protein.	Fat.	Carbo-hydrates.
Composition of the hen,	55.8	3.8	21.6	17.0	-
Composition of the egg,	65.7	12.2	11.4	8.9	-
A very fat fowl,	41.6	3.7	19.4	33.9	-
Composition of corn,	10.6	1.5	10.3	5.0	66.0

This chart shows the composition of an average hen, of the egg, of a very fat fowl and of corn. We see that corn fed alone — and the same is true of most of our other grains, generally speaking — is far from giving a balanced ration, but is a very one-sided feed. The hen, for instance, contains 3.8 per cent ash and the egg 12.2 per cent, whereas corn contains only 1.5 per cent ash. Again, the hen contains 21 per cent protein and the egg 11.4 per cent; the fat fowl 19.4 per cent and corn only 10.3 per cent.

The same is true of fats, as is seen when we compare the carbohydrates in corn with the fat in the hen and the egg.

The ratio of protein to carbohydrates in corn is about 1 to 9 in round numbers, so that if the hen which, under good laying condition, uses 4½ pounds of carbohydrates and fats to every pound of protein, is fed corn alone, she will be obliged to eat 9 pounds of carbohydrates and fats, or twice the amount she ought to consume in order to get a pound of protein. On the other hand, if we feed her too much protein in proportion to carbohydrates and fats she will be obliged to eat more protein than necessary. Whenever the hen must eat more of any one of the food principles than she really needs there not only is a waste of feed, but an extra strain is brought upon the digestive system to handle this excessive amount of food. We should see to it, therefore, that our hens have as nearly a balanced ration as possible, if we wish to be economical and keep the hen in the best condition.

A mixture of equal parts by weight of corn, wheat and oats has a nutritive ratio of about 1 to 8½. In order, therefore, to provide a balanced ration, we must feed something in addition to these grains that has a much larger percentage of protein. We have, therefore, adopted what we term the mash, a mixture of ground grains and by-products. By feeding such a mash, with a nutritive ratio of 1 to 2.3 to 1 to 3.6, together with about an equal amount of scratch feed, we place before the hen materials from which she can balance her own ration.

TABLE 13. — *Poultry Mashes.*

Mash 1.	Mash 2.	Mash 3.
200 pounds wheat bran. 100 pounds wheat middlings. 100 pounds corn meal. 100 pounds alfalfa (ground). 50 pounds beef scrap. 50 pounds linseed meal. 50 pounds gluten meal.	100 pounds wheat bran. 100 pounds wheat middlings. 100 pounds corn meal. 100 pounds fine ground oats. 100 pounds alfalfa (ground). 100 pounds beef scrap.	100 pounds wheat bran. 100 pounds wheat middlings. 100 pounds corn meal. 100 pounds ground oats. 100 pounds gluten feed. 100 pounds linseed meal. 100 pounds beef scrap.

We have in the above chart three different formulæ for poultry mashes, with some difference in their nutritive ratios, but all three well adapted to be fed with mixed grains. The last, or No. 3, is the richest in protein, its nutritive ratio being about 1 to 2.3.

TABLE 14. — *Scratch Feed Mixtures.*

First.	Second.	Third.
200 pounds cracked corn. 100 pounds wheat.	300 pounds cracked corn. 200 pounds wheat.	200 pounds cracked corn. 100 pounds wheat. 100 pounds oats.

If you have barley or buckwheat, you can add 50 pounds of either, or 50 pounds of both, to any one of the above grain mixtures. The exact composition of a scratch feed should depend entirely upon the relative cost of the grains and the ease with which they can be obtained. As already noted, however, corn is the cheapest grain for poultry, and should form about one-half the scratch feed in any case.

Our method of feeding layers at the college is as follows: the dry mash is kept before the hens all the time. From 3.30 to 5 P.M., depending upon the time of the year, they are given scratch feed in the litter, about 50 per cent more than they will eat at once, so that they will have some left to work on in the morning while the attendants are watering and doing some of the other chores about the plant. In the morning, from 6 to 9, as the other work permits, they are fed more of the scratch feed; and this is all the feeding that is done under the dry-mash system. But since, as a rule, we wish to force our layers to the highest possible egg production, we also feed a wet mash once a day, about 2 P.M., which is a convenient time because it works in very well with the other duties of the attendant. The same formula is used for the wet mash as for the dry, but when we have no mangels, beets or cabbages we use cut alfalfa in the mash, making it compose about one-third of the bulk. Green or succulent food is given every day or every other day, in the form of cabbages, beets, mangels, turnips or carrots, which, as a rule, are split open and laid on the floor or in a trough for the hens to pick, though vegetables like carrots are usually run through a feed cutter and cut fine. Grit, oyster shell and water are kept before the hens constantly. Potassium permanganate, enough to give a good red color, is placed in the drinking water, especially in the fall, when the weather is very changeable and the hens and pullets are apt to take cold. It is a disinfectant, not a medicine, and a teaspoon level full is sufficient for 12 or 13 gallons of water.

The question is often asked how much to feed a flock of hens, 10, 20, 25, and so on. Those who have had experience know that this question cannot be answered definitely, as there are a large number of factors that govern the amount. The principal ones are as follows: the size of the hen; the activity of the hen; the number of eggs laid; ability to digest food; size of the eggs; kind of house; kind of treatment.

If any one will send us these data, we can answer the question fairly well, but without them it is impossible.

We know that hens eat about 50 per cent more in April, when they are laying heavily, than in November, when they are moulting. In a general way, 10 hens will need on the average about $1\frac{1}{4}$ quarts of grain and $1\frac{1}{4}$ quarts of the ordinary mash per day, or about 4 ounces of feed per hen. Results obtained by the New Jersey Experiment Station conform very closely with this estimate, and Dr. Wheeler in his experimental work with hens, already referred to, came to about the same conclusion.

TABLE 15. — *Amount of Food consumed, Average per Hen per Year.*

	Pounds.
Grain and mash,	90.0
Oyster shell,	4.0
Dry cracked bone,	2.4
Grit,	2.0
Charcoal,	2.4
Clover,	10.0

This chart shows the amount of food annually consumed per hen at the Maine station, and the data were based on the average consumption of 100 hens for a year. It appears that each hen consumed about 100 pounds of grain, mash and hay, or just about 4 ounces per day, — a showing which should be of value in determining the amount of feed required daily for a given flock of hens.

What I have said above refers to feeding layers. In feeding breeders I would not use the same methods by any means. As previously stated, the main object in feeding layers is to get the highest number of eggs possible for the amount of grain fed, so they should be pushed to the limit. On the other hand, we are feeding breeders for an entirely different object. We want to get from them not merely eggs to be used as human food, but eggs containing strong, vigorous germs that will hatch well, and not only live but grow rapidly to maturity. We therefore must feed especially for vigor. The breeders should be separated in the fall from the layers, kept by themselves, and fed on dry mash and whole and cracked grains, given in deep litter. We do not want them to lay too many eggs in the fall and early winter because we believe this saps their vitality to a certain extent before the breeding season is on. If they are eating too much mash or laying too many eggs it is well to close the mash hopper during the forenoon and leave it open only afternoons. This will cause them to work harder for the feed, and keep them in much better condition for the breeding season. They should not be fed an excessive amount of animal food, as it has been found to be detrimental to the hatching ability of the eggs and to the growth of the chicks. The best kind of animal food for breeders is skim milk or buttermilk, which can be fed in large quantities without injuring them in any way.

TABLE 16. — *Data showing Effect of Various Animal Feeds upon Percentage of Eggs hatched.*

Pen Number.	ANIMAL FOOD USED.	Whole Grain (Pounds).	Dry Mash (Pounds).	Animal Food (Pounds).	Total Cost.	Total Eggs laid.	Cost per Dozen Eggs (Cents).	Per Cent Eggs hatched.	Cost per Chick (Cents).
1	Buttermilk, ...	720	233	1,453	$18 16	2,040	10.68	55.0	1.61
2	10 per cent beef scrap in dry mash.	840	337	34	19 85	1,670	14.28	50.5	2.51
3	Beef scrap in hopper, . .	900	216	141½	22 21	1,664	15.84	33.0	4.00
4	No animal food, . . .	900	224	-	17 99	1,496	12.69	59.5	1.76
5	Green cut bone, . . .	900	196	127¼	21 37	1,654	15.48	40.5	3.18

This chart shows the results of an experiment carried on at Guelph, Can., by Prof. W. R. Graham, head of the poultry department at that station. The best results were obtained, on the whole, from feeding skim milk, and the poorest results from feeding green cut bone and beef scrap in a separate hopper. This experiment covered a period from October to March, and all of the eggs laid by each pen, which contained 23 hens, were incubated.

From this and data from other experiment stations it is evident that in feeding breeders we should not feed too much animal food, unless in the form of milk; and not push them for high egg production during the fall and early winter, but give them plenty of exercise, free range if possible, and all the green food they want.

Feeding the broody hen is something that is sadly neglected by a great many poultrymen. I have been surprised to find that there are some who starve them for a number of days in order to break them up. This seems cruel to me, and also an expensive way of doing it. The main object of the poultryman is to bring the broody hen to laying again in the shortest possible time, therefore she should be fed on very rich feeds, and even tempted in every way to eat. So treated, most broody hens will begin to lay again in from ten to fifteen days. A stimulating mash should be given to these hens, if to no others.

In feeding poultry, the main thing after all is not the feed, the hens or the house, but it is the man with the feed pail. Hens may be overfed or underfed; they may be fed the wrong thing at the right time, or the right thing at the wrong time. The important factor in this work is judgment, and this can be used only by those who have had experience and know chickens thoroughly. I have seen men walk through their houses, feed their hens and never look at them. I once accompanied a man of this type through his house, and when we reached the other end asked what was the trouble with the hens in a particular pen, having noticed they had roup. The feeder replied that he had not noticed anything wrong, except that the hens in that pen were not laying as many eggs as the others. These men are automatic feeders, and feed as a matter of routine. We do not believe that a man can be successful with poultry who cares for them in this way. He should watch the hens eat as he throws out the grain, see if they are hungry, stir up the litter to see if they have eaten all he has given them previously, etc. One man has put it very nicely by saying, "When you go out to feed your poultry take one pail of feed and two pails of judgment."

Prices of Feeds and Poultry Products in Years 1898 and 1913.

In periods of high cost of living, we are apt to think only of the prices of articles that we buy for food, and give no thought to the value of the raw material entering into those articles. For instance, we hear people speak of the high price of eggs, that the prices asked are beyond all reason, as they can remember a few years back when eggs cost only half as much as they do now. They naturally think that either the producer or the middleman is filling his pockets at the expense of the consumer.

Table 17. — *Relative Rise in Price of Feeds and Poultry Products, 1898 to 1913.*

Price of Feeds.

Feeds.	Wholesale Price per Ton.	
	November, 1898.	November, 1913.
Corn meal,	$17 00	$32 50
Gluten feed,	17 00	30 00
Wheat middlings (flour),	17 00	32 00
Wheat bran,	16 00	25 50

Price of Poultry Products.

	Wholesale Price (Cents).	
	November, 1898.	November, 1913.
Eggs,	26–28	59–60
Dressed poultry,	13–14	20–22

From this chart, showing a comparison between the price of feeds and poultry products for the years 1898 and 1913, we find that in 1898 corn meal was selling at $17 per ton and at present is $32.50; gluten feed, $17 and $30, respectively; wheat middlings, $17 and $32, and wheat bran, $16 and $25.50. The prices for 1898 were taken from a bulletin published that year at our agricultural college, and the 1913 prices were obtained from our local dealers on ton lots. It is evident from these figures that the prices have almost doubled in the last fifteen years.

In regard to the prices of eggs and dressed poultry, we found the following quoted in "Farm Poultry" for the month of November, 1898: —

Eggs (fresh), ...	26 to 28 cents per dozen.
Dressed poultry, ...	13 and 14 cents per pound.

For the year 1913 the following prices were obtained at the Boston markets, on the eighteenth day of last November: —

Eggs (fresh), ...	59 to 60 cents per dozen.
Poultry, ...	20 to 22 cents per pound.

From this it is seen that eggs have practically doubled in price in the last fifteen years, but that dressed poultry has not.

This comparison, on the whole, is not a very fair one, because we are taking the price of eggs when they are the highest of any period of the year, and poultry prices when they are the lowest, because at this time the market is flooded with all kinds of roasters, including hens, chickens, cocks, etc. This surplus is dumped upon the market for whatever it will bring.

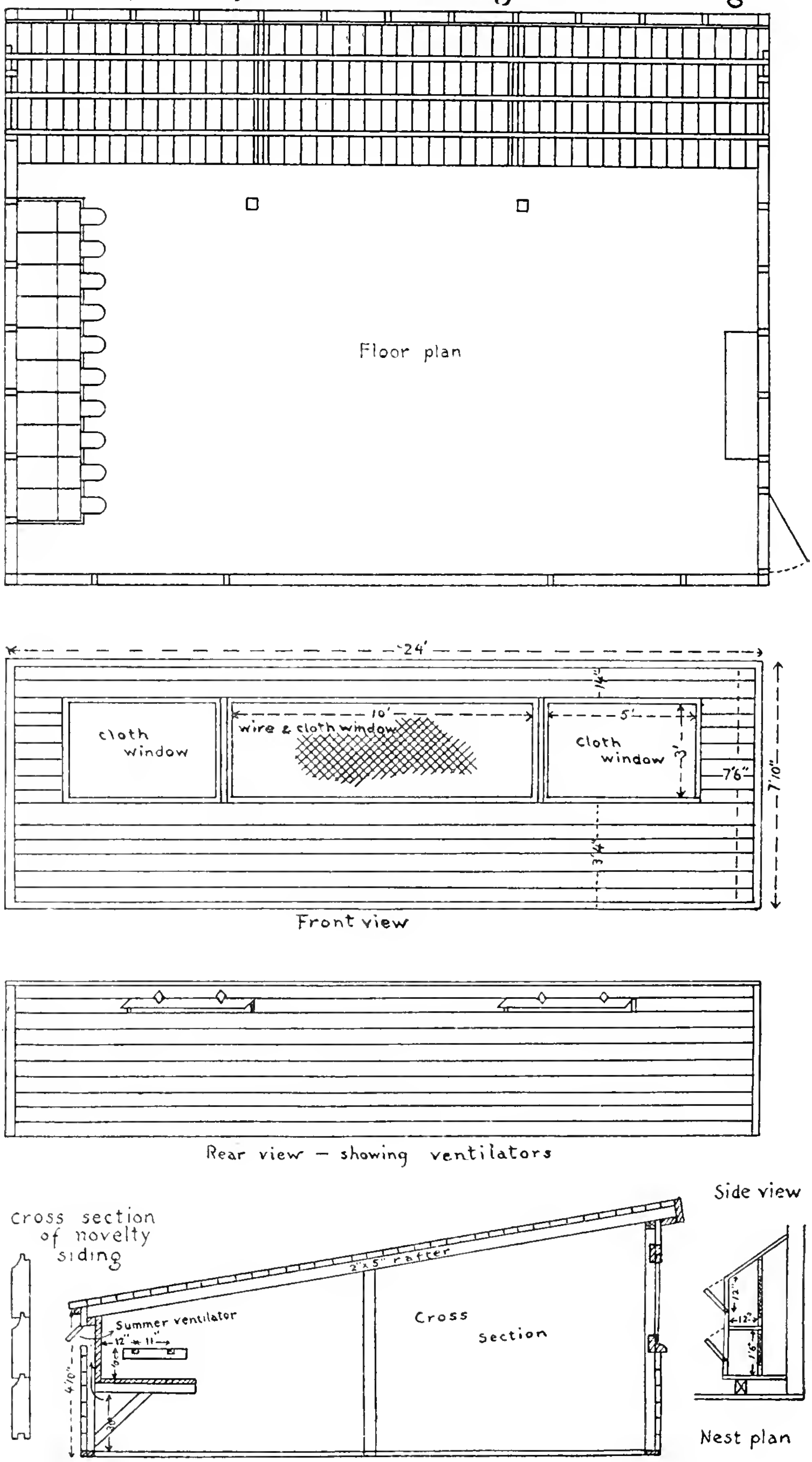
Chickens in the Corn Field.

In husking and weighing the corn taken from one row across our patch at the college poultry plant this season, we found that the yield was 58 bushels per acre. We considered this an excellent showing, because corn was on the same ground last year, and the only fertilizer we used was about $1 worth of potash per acre. Poultry ran on the ground both last year and this. Furthermore, part of the land was cultivated only once during the season and the remainder only twice. Not a weed was to be found in the corn field at any time. The chicks were quite large when the corn was planted, and they were allowed to run on the land while it was coming up, but did not injure it at all, although some of them were about two months old at that time. There is no better place for raising chicks than in a corn field, as it not only furnishes feed for them but also shade, and the ground being cultivated, continually furnishes worms and bugs. The leaves of the corn act as a sieve and catch a great many bugs and insects from the air. These fall to the ground and are eaten. Moreover, the standing corn acts as a good wind break in the fall and fodder can be used for litter.

Any one who has land suitable for corn should by all means try to raise some in connection with the growing of young stock.

There has been considerable discussion as to the amount of poultry and eggs produced in this State annually, and also the amount consumed here. It is impossible to get at anything absolutely definite on the subject, but data secured by Dr. Brigham, author of "Progressive Poultry Culture," show that annually there are produced in Massachusetts about five million dollars' worth, while about twenty to thirty million dollars' worth are consumed. These data were secured several years ago, so at the present time we no doubt produce six million dollars' worth at least. An estimate of last year's consumption of poultry and eggs in Massachusetts, based upon the methods used in determining the amounts consumed in New York City, would give us about forty-seven million dollars' worth. Whether it is twenty-five, thirty or forty-seven million dollars' worth does not matter particularly, as the difference between production and consumption is great enough at any rate to assure us that the poultry business in Massachusetts is not overdone.

Plans of Poultry House at the Agricultural College



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FARM WATER SUPPLIES.

By S. P. Gates.

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FARM WATER SUPPLIES.

BY S. P. GATES.

The question of the development of adequate and dependable water supplies for farms, situated beyond the limits of municipal supplies in Massachusetts, is yearly becoming a more serious problem. Until recent years most farms in the Bay State have depended for their water supply upon one or more dug wells or springs which, according to local traditions, "have never been known to go dry." Many farms are dependent entirely upon such sources for their water supply to-day. It is conceded that many of these old wells and springs which thrive only when moisture is abundant and the rainfall plenty, "never did go dry," prior to a decade ago. In those years a few hogsheads of water a day, obtained oftentimes under difficulty, sufficed for all requirements.

To-day the progressive farmer is seeking to obtain the advantage of certain luxuries on the farm, common to city homes, and the water consumption for domestic purposes alone has increased to a surprising extent. Beyond this, and of special vital importance from an agricultural standpoint, the problem of an abundant water supply for irrigating purposes is frequently a most perplexing and serious one. This is due to the fact that the demands upon these surface supplies are greatest in seasons of the year when, because of climatic conditions, the least amount of water is available. Surface springs and dug wells are supplied by the immediate rainfall, and, such being the case, the shortage of water from these supplies can be more readily understood after studying the official reports bearing upon the rainfall in Massachusetts, as prepared by the State Board of Health.

These observations were taken upon the Sudbury River watershed, and show the average rainfall for periods of five years since 1890.

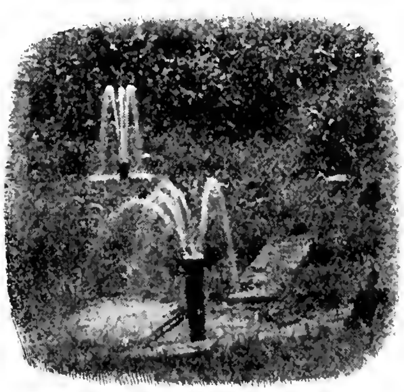
	Inches.
1890 to 1894,	46.56
1895 to 1899,	46.72
1900 to 1904,	48.16
1905 to 1909,	41.81
1910 to 1911,	37.01

The comparatively light rainfall of recent years, the evaporation during the hot dry months of summer, and the increased consumption all figure prominently in the shortage of water from surface sources in the farming district.

The problems involved in the development of water supplies that can be depended upon during all seasons of the year have already been successfully worked out for many large farms and private estates in Massachusetts by those equipped by study and experience to prescribe the best method after examining the conditions.

The development of water supplies from underground sources, or deep down in the bed rock, while long regarded as a mystery has proven to be the solution of the problem.

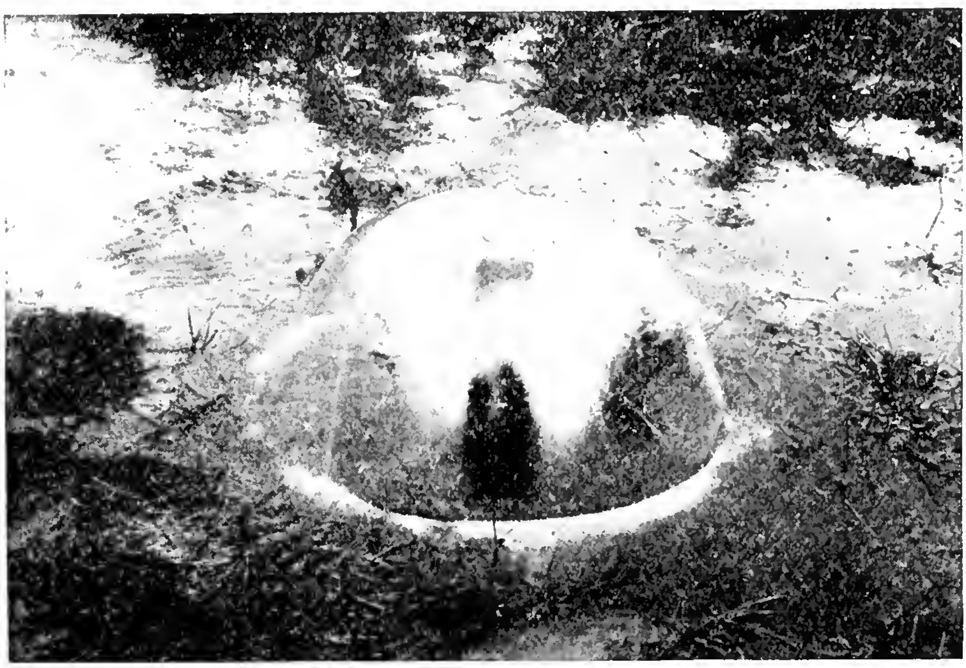
The water which falls upon the earth in the form of rain is disposed of in three distinct ways, — one portion suffers evaporation, a second portion runs over the surface and escapes into brooks and streams, while a third portion sinks into the ground. This third portion usually pursues a subterranean course, and during its journey frequently collects into well-defined channels and lakes. A careful study of the surface contours and geological conditions is necessary in locating these underground collecting basins. This must be done in order to determine the natural water courses in relation to the surrounding country and the position and inclination of the underlying bed rock, and to locate the deposits of sand and gravel without which no great amount of water can be obtained. In some places hereabouts, where surface indications might lead us to believe a good supply of water exists, none can be found. This is due to the fact that the stratum below the surface is very fine, hard-packed sand, or hardpan, which is practically impervious to water. Whenever in low land the formation is coarse sand or gravel, inexhaustible water supplies can be developed by the driven well method.



Flowing Wells at Stoughton, Mass., 35 feet deep.

Such wells are put down by hand and penetrate the gravel to a point where the best results are to be had. They were first driven in this region in about 1870. At the beginning they were merely pipes driven into the ground at random, and results were very uncertain. Locations are selected now with reference to the drainage area and the overlying earth deposits. These wells average from 35 to 40 feet in depth in Massachusetts, and will often yield from 40 to 50 gallons of water per minute. There are a great many systems of driven wells in the State to-day furnishing large supplies of excellent water for cities and towns, farms, institutions and industrial plants. Most of these systems consist of a number of $2\frac{1}{2}$-inch wells connected to suction pipes of ample size to take care of the volume of water to be handled. They are connected in a way to produce the least possible friction, and the water from the main suction passes through a sand and air separator, thence to the pumping engine.

The most notable of the driven-well systems in Massachusetts is the municipal water supply plant at Lowell, where 5,500,000 gallons of water per day are pumped from wells of this type. In many

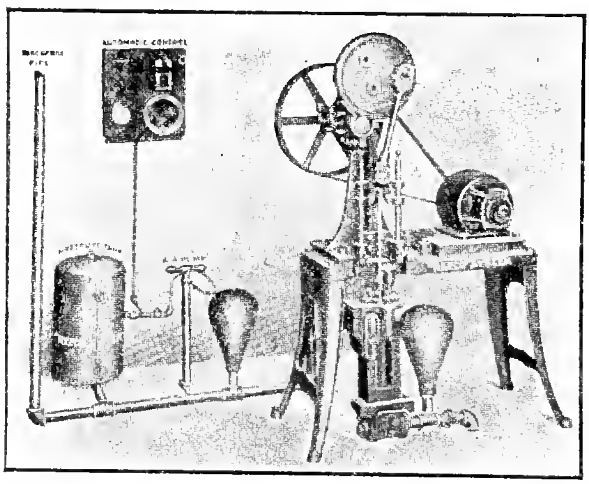


Flowing Well at Kingston, Mass., 40 feet deep.

farming districts of the State it is possible to obtain abundant and permanent water supplies by this method.

The glacial deposits which overlie the bed rock throughout the State are variable in character. Wherever this deposit is clay or hardpan the driven well system is impracticable, but there is the deep drilled well to resort to. In sinking these wells an outer casing is driven down by steam power until rock is encountered. Upon striking the bed rock a hole of approximately the same diameter as the casing is drilled into it for several feet, and then gradually tapered down to the proper diameter to receive a smaller casing. This inner pipe constitutes the permanent well casing, and is firmly driven into the tapered hole, effectively shutting out the earth formation above the ledge. From this point the drilling is confined entirely to the bed rock. This bed rock in Massachusetts, like the glacial deposits, is variable in character, but is for the most part seamy, and these seams or fissures are water-bearing. In drilling, the seams are cut, and the water when released flows upward into the well and is ready to be pumped. The yield from wells of this type cannot be predetermined, but such wells are rarely failures. Data taken from the records of the pioneer artesian well company in the State, indicate the average depth of these wells to be from 250 to 300 feet, and the average yield from 50 to 60 gallons of water per minute. These deep wells furnish most satisfactory supplies, as the water is usually in a high state of purity and can be depended upon at all times, inasmuch as it has access to the wells at depths where it is not affected by surface conditions.

Unlike hand driven wells, surface conditions do not show the depth and dip of water-bearing seams in the bed rock, and they cannot be determined until the work is in progress and the seams opened up in drilling. Consequently wells of this type, in most



Electric Pumping Outfit.

cases, may be located at any convenient point in relation to the building to be supplied, thereby eliminating long lines of piping.

Progressive well drillers, as a rule, keep accurate records of the formations passed through, and the depths where water is found. Accordingly, where work of a similar nature is contemplated, the best way to determine the probable depth and yield of a deep well is to consult the records of firms having had experience in the general location of the proposed work.

The modern drilled well, when properly constructed, is immune from the evils common to dug wells and other surface supplies. The method of connecting the well casing to the bed rock, from which point the well is cased all the way to the pump, prevents contamination from surface drainage and insures against the entrance of insects and reptiles.

There are various methods and so-called "systems" in vogue today for pumping, storing and distributing the water obtained by the methods as described above. Named in the probable order of their importance and popularity, the list of pumps is as follows: the electric pump; the gasolene engine driven pump; the steam driven pump; the hot air engine driven pump; and the windmill. For storing and distributing, the pressure tank, the gravity reservoir of concrete, and the gravity tank of wood or steel, on a skeleton tower of wood or steel, about cover the field.

Where electricity is available, the electric pump is probably the best solution of the pumping problem, as with this power the controlling switch may be located in the house or barn, where it will be accessible at all times, irrespective of the location of the pump. This is of considerable importance during the inclement weather of the winter season, and, coupled with the simplicity and safety of operation, which is such that a child or woman properly instructed may with impunity be appointed engineer, makes the electric pump the most desirable. Another feature which recommends the electric pump is the automatic control to which it readily lends itself, the pump automatically, and without manual assistance, starting and stopping as a high and low water level or a high and low pressure is obtained in the storage tank.

The advent of the automobile and the motor boat has gone far to popularize the gasolene engine as a motive power to drive the farm pump, having overcome the fear which many farmers had for gasolene, as well as creating, practically overnight, an abundant crop of gasolene engine repair shops, no town now being too small or isolated to support at least one dealer or mechanic capable of repairing any of the current makes of gasolene engines. The gasolene engine driven pump is compact and self-contained, and may be quickly started by a competent operator. It is highly efficient, and in general gives good satisfaction, being less desirable than the electric pump only in the fact that it requires considerable physical strength on the part of the operator, and cannot readily be automatically controlled. This is at times a hardship, especially during the winter season, if the location of the engine is at a considerable distance from the dwelling house.

The steam driven pump is too well known to require discussion, but is rapidly losing caste as a farm pump, owing to the cost of coal and of its transportation, or the necessity of constantly replenishing the fire, if wood is used as fuel. The amount of time required on the part of the operator tends to further discourage the present-day farmer in the use of this type of power. Also, in many cases, the electric or gasolene engine driven pump may be installed in a building already erected on the farm, whereas the use of the steam pump usually means the construction of an entirely new building.

The hot air engine driven pump is probably the simplest and safest engine driven pump on the market at the present day, but owing to its rather limited capacity, together with the element of time required on the part of the operator, causes its value as a farm pump to be rather questionable. This pump, however, is almost ideal for purely domestic use in a country house or summer cottage, where the use of water is comparatively limited and electricity is not available.

The windmill of our grandfathers' time needs no description. It has been a good and faithful servant, but the march of progress along the pathway of farm efficiency has discarded it together with many other implements and methods more or less primitive. Its chief sins are, or more properly speaking were, the inevitable yearly repairs due to the exposure to the elements; the hardship of climbing the tower to lubricate the mechanism at the top; the noise and unsightliness; and last and most important of all, the fact that the operation of the pump depended entirely upon the action of the wind.

For storing and distributing the water about the farm the pressure tank is without a rival. This type of tank is usually buried just outside the house or barn cellar, with one end of the tank protruding through the wall into the interior, thus providing an accessible and frost-proof location for all controlling valves. In larger installations a special pit is constructed around the head of tank or tanks. It is, of course, desirable about the farm, for agricultural as well as live-stock purposes, to preserve an even temperature of water the year round. This the pressure tank does to perfection, the water being drawn from the tank at practically the same temperature at which it leaves the well, irrespective of the season. Also a much larger measure of fire protection, as well as a better pressure for sprinkling and spraying, is obtained from the pressure tank than would ordinarily be obtained from a gravity system.

The gravity reservoir of concrete is possible only where the ground elevations are suitable, and the cost of construction, together with the cost of piping, should be carefully considered before this method is decided upon. The wooden tank on a skeleton tower of steel or wood is probably the cheapest and most common of gravity systems. The points to be considered in connection with this system are the limited pressure obtainable, the unsightliness and the difficulty of adequately and economically frost-proofing the tank and piping.

In conclusion, it should be said that the water-supply problem on the farm is one worthy of considerable thought from an engineering standpoint, and it is well for the farmer who contemplates such improvements to consult with the engineers of a reputable house engaged in the business before making up his mind as to the system best adapted to his needs.

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THE NEW ORCHARD.

By Prof. F. C. Sears.

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THE NEW ORCHARD.

PROF. F. C. SEARS OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Doubtless many in the audience are familiar with the Bay Road Fruit Farm, which is "The New Orchard" referred to in the title on our program, but it may be worth while for the benefit of those who are not, to state that it is an orchard at Amherst which was started in 1908 by Professor Waugh and myself, and which now comprises about 125 acres.

It is not my purpose to discuss all the problems that have come up in the development of this orchard, but rather to select a few of the more important, and those which are likely to be of more general interest.

First, a few words in regard to the character of the plantations which have been set. Many fruit growers consider that one line of fruit is sufficient, such as apples or peaches, and some even go so far as to say that if one is growing apples, a single variety, or two at the outside, will give the most profitable returns. As a general proposition this is probably true. It reduces the number of questions about which the owner must have expert knowledge, and allows him to concentrate on a few lines; and every one will agree that the profits from many orchards have been reduced owing to the multiplication of varieties. But it has seemed to us that there was another and very important side to the question, and that is the better distribution of the labor required where one plants several varieties of any fruit and several different kinds of fruit. For example, if a man ties up to the Baldwin apple, which all will agree is the most profitable single variety of any fruit, he has three or four seasons of the year during which he is rushed with work. These are the seasons of pruning, spraying, picking and cultivation (if he cultivates). During the balance of the year he has practically nothing to do in his orchard. On the other hand, if he enlarges his list of varieties, and still more if he includes several classes of fruits in his plantings, his season for labor is very decidedly extended. In the matter of picking, for example, instead of having it all come in two weeks, the last of September and the first of October, his picking season extends from the last of July to the middle of October, which is a very decided advantage. Another point which has influenced us in increasing our list of varieties somewhat, and in planting other fruits than the apple, is that this enables one to hold his customers better. One customer may want Sutton, another Wagener and another Palmer Greening. For the grower who is catering to a personal market, the ability to offer a choice of varieties is certainly worth considering.

Looking at the subject in this way, while we have made apples our leading fruit, we have also set peaches, pears, plums and quinces, and we expect to add grapes and cherries. Our list of important varieties in apples is, in the order of ripening: Yellow Transparent, Red Astrachan, Oldenburg, Wealthy, McIntosh, Hubbardston, Sutton, Palmer Greening, Wagener, Rhode Island Greening and Baldwin. Of course we have set many more trees of some of these than of others. Probably five-sixths of the plantings are made up of Baldwin, McIntosh, Wagener, Rhode Island Greening and Palmer Greening.

In peaches we have set: Greensborough, Carman, Champion, Belle of Georgia and Elberta. This gives a good succession, though not a perfect one. There are breaks in the line which we want to fill in; and we especially need a variety that is later than Elberta.

A question which we have found it very difficult to settle is what crops to grow among the young trees during the first few years of the orchard. To be satisfactory a crop must first of all leave the trees in at least as good condition as they would have been without it, and second, it must be profitable to the owner. This is a difficult combination to get; at least,

Barley as a cover crop.

we have found it so. To be a benefit to the orchard the crop must require good cultivation, and must not spread out so as to shade the trees or rob them of food; and it is very desirable, also, that it should make its greatest growth at a different period from the trees. In order to be profitable it must be a crop which the owner can use to advantage on the farm or which he can sell for cash. As we keep no stock, other than our teams, there is little that we can use except hay and corn, and of course hay cannot be grown in an orchard. We have not considered it advisable to go into truck crops, and we are therefore restricted to general crops that can be sold for cash. Those which we have found most satisfactory under our conditions are: beans, soy beans, corn, potatoes, cabbage, squash, strawberries. Even strawberries we find objectionable in any but very young orchards because they prevent cross-cultivation, and still more because they require to be kept in the land two years. It is impossible to keep the young trees in as good condition where the land cannot be given a thorough preparation in the spring.

Another question which has caused us no end of difficulty, and which we have not yet solved to our entire satisfaction, is the old, perennial question of cover crops. Many people think this question was settled years ago. As a matter of fact, it never was settled, and probably never will be except as each man settles it for himself, and that temporarily. The most important offices of a cover crop are the following, arranged roughly in the order of their importance: —

1. To add humus to the soil.
2. To prevent washing of the soil.
3. To check the growth of the tree.
4. To add nitrogen to the soil.

In addition to this, if the crop is to be used on an orchard of any size, and if the owner is not a millionaire, the seed must be reasonably cheap.

It might seem like a relatively simple matter to grow a good crop of some plant in the soil in the early autumn which shall accomplish all of the things mentioned above, and not be very costly, but in our case, at least, it has not proved so. Our soil is relatively light, which probably makes it more difficult to grow good crops, and it was badly run out when we began, which undoubtedly complicates matters. At the present time the following are our most promising crops: buckwheat, barley, dwarf Essex rape, turnips, soy beans and rye. The great advantage of buckwheat is that it will grow almost anywhere and that it leaves the soil in fine condition. Also that it tends to reseed itself from year to year, so that one saves on the bill for seed. This is a very important point, and I believe that by changing our methods a little we can get cover crops that will almost always reseed themselves. The change in methods would be principally in the direction of shortening the season of cultivation, so that not all of the seed will have sprouted before it comes time to "lay by" the orchard. Another practice we have found helpful in getting a good growth of cover crop is to apply a little fertilizer when the cover crop is sown. In fact, we are even contemplating changing the time for applying our orchard fertilizers from early spring to the date at which the cover crop is sown, for of course in the long run the trees get the plant food which is taken up temporarily by the cover crop.

A point in favor of turnips and dwarf Essex rape is the low cost of seed. Two pounds will sow an acre, and the former costs about 35 cents a pound, while the latter can be had for about 8 cents. Where one is sowing a large acreage this low cost of seed looks very attractive. A further advantage of turnips is that under anything like favorable circumstances a good many of them will grow large enough to be marketable. One can then go through the patch and pull out enough to more than pay for the cost of the crop, and still have a good stand to act as a cover.

It might be of interest to say just a word about some of the orchard implements that we are using, because in the handling of an orchard our success depends to a great extent on what sort of tools we have to work with. While we have a great many different implements, the three which we use most are the "light-draft orchard harrow," the "California orchard plow" and the "orchard cultivator." The first mentioned is a light form of spring-tooth harrow, mounted on

The California orchard plow.

wheels, and it comes nearer to doing all the work in the orchard in one day than anything else I have ever seen. Our teams have done as much as 20 acres in a day with this harrow. The California orchard plow consists of a gang of four discs at the end of a long beam, and its strong point is that one can get close up to the trees with the plow and still keep the team well away. We have found it better than any other plow we have yet tried. The "orchard cultivator" is an implement with rigid teeth, and is especially useful where there is hard work to be performed; that is, where the soil is heavy and the weeds are bad. Under such conditions the light-draft harrow will not work satisfactorily.

A practice which has become a regular thing in our orchards is thinning the fruit. I believe that it is hard to overestimate the value of this operation. It not only gets rid of the poor, defective specimens that would be of little or no value at picking time, and so relieves the owner of the necessity of deciding what to do with them, but it also relieves the tree of the strain of developing these fruits to maturity, and consequently makes annual crops more probable.

Many people are deterred from thinning by the idea that it is an endless and costly job. Our advice to such people would be to try it. We have had our thinning done principally by boys about fifteen years of age, and we find it costs us about 40 cents per tree to thin the fruit on full-sized bearing apple trees, and about 2 cents to thin a peach tree that will bear two to three baskets. With the apples our practice is to go over the tree twice, the first time about the 10th of July and the second time a month later. The first time our orders are to thin so that no spur will have two apples. Defective fruits are also removed. The second time we look especially for defective fruits, but also thin out where the fruit looks thick. I do not believe any other practice, with the exception of spraying, is more important if one wishes to grow the best fruit.

I cannot let this opportunity pass without mentioning the record of a small Baldwin orchard that was on the land when we bought it. The trees are probably thirty-five years old, and were so poor that it was seriously suggested that they should be cut down and a " real orchard " set in their place. But instead of this they were pruned and fertilized and sprayed, with the result that the third year they bore 200 barrels of apples and the fifth year 175 barrels, for which we were offered $1 more per barrel than the market price, on account of the quality of the fruit. There are hundreds of old orchards in the State that would do as well if they were given the same treatment.

We start in the spring with pruning and dormant spraying, and this is followed by spraying our apples for codling moth. If we had only peaches we should omit this spraying. Then later on we spray our peaches with self-boiled lime-sulphur, at a time when there is little to do in the apple orchard. Then all of our lower lands are seeded down to hay, a crop that lends itself admirably to the profitable distribution of labor, because haying comes in just as we are through spraying and is out of the way just in time to begin picking the earliest peaches.

Now a few words in closing about marketing our fruit. We have worked principally to develop a family trade in fruits, and personally I believe that this is by far the most valuable kind of trade. I had rather sell a man five barrels of apples at $4 a barrel than two boxes at $2.50. On the other hand, we must not overlook the fact that the less fruit one sells a customer at one time the more that customer is willing to pay. At two apples for 5 cents (a very reasonable price where one is buying a few apples to eat) a barrel of apples (estimated at 350 apples) will sell for $8.75. In fact, I believe that if growers could persuade their groceryman to handle the fruit on a commission, some form of small basket or carton would be very profitable. This plan not only gives the advantage of better prices to the grower, but it gives him a certain control over the price, which is very desirable.

Mr. Taylor. Where would you prune a two-year-old tree?

Professor Sears. I wouldn't prune it at all until next spring.

The light-draught orchard harrow.

Mr. TAYLOR. But in the spring where would you take the top off?

Professor SEARS. Way down in here somewhere (indicating).

Mr. TAYLOR. Doesn't the nitrogenous quality of Winter Vetch somewhat overbalance the cost of it?

Professor SEARS. Yes, it would. That is a point I thought of but haven't emphasized. Yes.

QUESTION. What do you do with the fruit you thin out?

Professor SEARS. We haven't done anything. Even the second thinning is so early that it has no value; the fruit at the second thinning is still so small and immature that I don't think it will bother you. I think you will find the greatest difficulty is to get your men to thin it enough. The tree looks fearful when you get through; the ground is covered with fruit, and it doesn't seem that there is any left on the tree, but when you come around to picking time I think you will wish you had thinned more. I think that is the experience of every one who has thinned, that he couldn't get his men to thin enough; but if you can get the boys to realize that they are your trees and realize what the purpose is, and you can get them to carry out instructions until there is only one fruit left on the spur, you will be surprised at the result.

Mr. TAYLOR. I was very much interested, when I went over your orchard, in seeing the development of fruit spurs on what we call the water sprouts in the center of the tree.

Professor SEARS. In the old trees?

Mr. TAYLOR. Yes. It was something new to me.

Professor SEARS. The chairman calls attention to the fact that we have been able to develop fruit spurs on a lot of the water sprouts. That has been rather good, I think. Commonly we wouldn't have satisfactory development of fruit spurs, and so we took the water sprouts, and undertook to develop paying wood, or fruit spurs, on those, and we have been reasonably successful, I think.

Mr. TAYLOR. How long do you run those fruit spurs? Do you leave the stubs more than two years?

Professor SEARS. The idea is simply this: if you have an old tree where the small branches have been cleaned off so that it isn't paying, so that you are getting no return from that section of the tree, the only way you can get it back is by developing the water sprouts and developing fruit spurs on the sides of those, and after those come up go right down to perhaps within two or three inches and make them throw outside shoots, and the tree will start bearing, and if we find that it isn't doing as well as it should, we cut them out.

Mr. Gleason. I would like to ask the professor what fertilizer he uses on these orchards.

Professor Sears. I might say that we very strongly believe in the practice of fertilizing orchards, and those of you who have kept track of the recent discussions on fertilization know that the results in the different stations have been very varied. They have run all the way from the Pennsylvania station, which has shown very marked advantages from fertilization, to the work at Geneva, N. Y., where they concluded that they didn't find any virtue in it, and not only that, but they didn't get the money back that it cost to put the fertilizer on. There is one other experiment that ought to be recorded, and that is at Amherst, where we have planted primarily to test the advantage of different forms of fertilization by potash. I won't enter into that question now, but, incidentally, in the center of that orchard was a block that didn't receive any fertilizer, and the result has been that that block which didn't receive any at all has been way behind the other blocks. No matter what fertilizer has been put on, those others have been way ahead. To my mind, that, and the Pennsylvania station experiment, are proof enough that under most circumstances fertilization is a good thing, and that has been the way in which we have handled our orchard. We have not only put on nitrogen for our young trees to start off with, but we have gone on the assumption that it was a good thing and would encourage them in coming into bearing. We have furnished also potash and phosphoric acid for our young trees. We have used nitrate of soda, a couple of ounces, perhaps, to each tree, and acid phosphate and high-grade

Low-headed peach trees.

sulphate of potash, making them up at the rate of 5 pounds of phosphoric acid and 3 pounds of potash. On the old orchard that we renovated we have used each year 500 pounds of basic slag and 300 pounds of potash, and on all our orchards we have used a good quantity of fertilizer, almost always in these forms that I have mentioned; that is, we used basic slag, as a rule, on the old orchards that were cultivated, and always high-grade sulphate of potash; and for our young trees we usually used acid phosphate or phosphoric acid; and then we have used lime as I have suggested, more on crops than on the orchards. I think that is very important for the trees, particularly on land that has been seeded down.

Mr. Taylor. How much lime do you use?

Professor Sears. We have been putting on a ton per acre. I know that Mr. Haslett at the station said that some persons said it would require 5 tons per acre, but I wouldn't advise putting on that quantity. Put on a ton per acre to start with.

Mr. William Hanson. Did you ever see a man cutting a McIntosh tree? I set out an orchard two years ago with McIntosh fillers, and I had a man tell me this summer that he never had the heart to cut his out. I am going to set out another orchard next spring, and he advises me to put them in blocks and not use the McIntosh for fillers, because I would never have the heart to cut them out.

Professor Sears. Well, that is coming right back at me, certainly. I have never seen a man cutting out McIntosh, but I have seen men cut out Wagener and Wealthy, and if I had the heart to cut out Wagener I think I would have the heart to cut out McIntosh. I quite appreciate the difficulty, and I am quite certain that perhaps the rank and file won't have the grit to cut them out. My idea is that if we find we haven't the grit to do it, we can have the hired man cut them out while we are gone. [Laughter.]

Question. I would like to ask what percentage of wood you would cut out on an old orchard when renovating it?

Professor Sears. That is a question that it is impossible to answer. It would go, I should say, all the way from 90 per cent down to perhaps 4 or 5, depending on the condition of the tree. In our work in renovating we started in and cut out dead wood, and if you have a particular tree in mind, you will know how much will be left on the tree when you get through with it. My boys have been working for the last three weeks on renovating old trees, and they were instructed to cut out the dead wood. I was talking it over with the class to-day, and we agreed that the cutting ran all the way from 16 up to 50 per cent dead wood, so you see there is considerable variation according to the tree itself. Then, after you have got the dead wood out, the question comes up what else to do; but after you have cut out, say, 60 per cent, that is about the time you quit; there isn't much of anything left. But in an ordinary tree of the type I have seen renovated, I should think it would run somewhere around 25 per cent. Of course, it is impossible to say without knowing what the tree looks like.

Mr. Brennan. I would like to ask the professor if I understood him correctly when he said they were considering fertilizing cover crops? Is that fertilizing coming at a time when it will introduce a growth of new wood?

Professor Sears. I am glad you raised that point. We don't at that time put on any great amount of nitrogen to start with, but the cover crop will use up most of the nitrogen. Then, you would not get very close to the tree with the fertilizer. If you wanted to get it satisfactorily you would keep away from the tree with the fertilizer. We have tried it to a limited extent, but the dressing of nitrogen, or whatever we were using, would be relatively light.

Mr. Hanson. I would like to ask what kind of fertilizers will give color to apples.

Professor Sears. Why, I don't know. I doubt if any one knows. The men here in this audience are better qualified to discuss that than I am, but the latest evidence I have heard seems to be rather against the view that any fertilizer actually gives color. You can destroy it by the use of too much nitrogen, but evidence seems to be lacking to abso-

Heading back a four-year-old apple tree.

lutely prove that you can increase it, unless possibly by the use of potash.

Mr. George Packard. On the question of filler trees, I would like to ask why peach trees couldn't be used, which live but a few years naturally, anyway, instead of apple trees, which are valuable. I think it is almost a crime to kill a Wealthy tree.

Professor Sears. Yes, peach trees will die in several years, and if it will ease your conscience any, that might be better for you, Mr. Packard. Still, I don't think it is any more of a crime to cut out a McIntosh tree than it is to go into that McIntosh tree and then cut whatever limbs are necessary. The two stand right together. I know a man feels a little worse about cutting out a tree than he would about cutting out some limbs.

To answer the other question about peach fillers, that is a legitimate practice, and a good many people do it. We have done it ourselves, but I have two objections to it, and I think they are legitimate objections. The first is that you quite frequently come to a point where you want to handle the soil differently for the peaches than for the apples, particularly in the matter of the fertilizers which contain considerable nitrogen. Here is a good illustration which comes to my mind now. The college has a block of apples, interplanted with peaches, trees about eighteen years old. In 1906, I think it was, the peaches were much damaged by a hard winter; and after a severe pruning in the spring it was desired to push the peaches along, and so they were given a good application of nitrate of soda, which the peaches wanted, and some of the trees are still in good shape in the orchard now. The apples, however, which include McIntosh and Wealthy and Baldwins and various standard sorts, were just coming into bearing nicely, and they didn't want any nitrogen; it was just what they didn't want. Well, the result was that they started off to a big wood growth, and have been trying to get over that ever since. That was six years ago, and they are just getting sobered down where they would have been if it hadn't been for that nitrate of soda. So I think that it is an objection; that you frequently come to a point where you want to treat the soil differently for peaches and for apples.

Another objection is one also frequently noted, that you want to spray with different material or at different times, and you have got to go back and forth from one tree to the other, and if you simply make up your mind to do it at different times, it means you have got to go over the orchard twice, which adds to the expense. Those are my reasons for not liking it, but I have seen it overcome in a number of cases and have put in peaches, but I don't think it is the best practice, and I entirely agree with the gentleman who said it is best to put a tree in and when you get through with it cut it out.

Mr. IRWIN. Don't you consider the McIntosh better than the Baldwin to-day, for money?

Professor SEARS. Well, I don't know. Yes, to a limited extent I consider it better, but I am a great friend of the old Baldwin, myself. It is an apple to tie up to week after week and night after night. The Baldwin is as good as anything you get.

Mr. IRWIN. But it doesn't bring the price.

Professor SEARS. No, I know it doesn't bring the price. I don't want to say anything against the McIntosh, because I think it is a fine apple.

Mr. PACKARD. I would like to ask this as to fertilizers. If the peach-tree fertilizer harms the apple trees next to them, why couldn't the application of fertilizer be made locally? Some years ago I set out an orchard with peach trees in between, and in due course the peach trees died. The apple trees came right along as well as could be expected of any apple trees, and I lost nothing by it.

Professor SEARS. The difficulty is that the roots don't stay where they belong; the peach-tree roots go right among the apple roots, and the apple-tree roots go right among the peach-tree roots, and if you have these trees 20 feet apart, at the age when the fertilizer would be applied, undoubtedly the apple roots would be trying to occupy all the soil, and so would the peach roots, so that when you put any fertilizer on it would be on both of them at the same time.

THE MOST IMPORTANT FACTORS IN SUCCESSFUL FARMING.

G. F. WARREN, PROFESSOR OF FARM MANAGEMENT, CORNELL UNIVERSITY.

During the past six years we have been securing from farmers in New York State records of their capital and business receipts and expenses, in order to find out how much farmers are making, and why some are making more than others. During this time we have obtained records of 2,917 farms.

From seven years' study of this question we have determined the relative importance of different factors on profits.

Labor Income defined.

In order to understand this discussion it will be necessary to know what is meant by labor income. By this we mean the amount of money that the farmer has made in addition to interest on his capital. It corresponds to a hired man's wages when the hired man receives a house and some farm products.

Table 1 shows the averages for Tompkins county.[1] The average capital on these farms was $5,527. This includes land, buildings, stock, machinery, tools, feed and seed on April 1 and cash to run the farm. The average receipts for the year were $1,146. Any unsold products or increase in animals is counted as a receipt. The average expenses were $389. This includes all business or farm expenses. It

[1] For a fuller discussion of methods of work and other conclusions, see Bulletin 295 of the Cornell Experiment Station. The purpose of this work is not to compare farming with city work, but to study the relation of various factors to profits in farming. The hired man and the farmer get many farm products from the farm. These and very many other factors must be considered in order to compare farming with city work. Labor income is an excellent means of measuring the success of a farmer, as it is directly comparable with hired man's wages when the man gets a house and farm products.

does not include any personal expenses, but includes the value of board furnished to hired help. The difference between the receipts and expenses averaged $757.

TABLE 1. — *Averages, Tompkins County.*

Number of farms,	615
Average capital,	$5,527
Average receipts,	1,146
Average business expenses,	389
Receipts less expenses,	757
Interest at 5 per cent,	276
Income from unpaid labor,	481
Value of unpaid labor except owner's,	58
Labor income,	423

This $757 was earned by the farmer's money and the work of the family. Money can readily be loaned on farm mortgages at 5 per cent. Hence, only $481 can be said to have been earned by the labor of the farmer and his family. The unpaid farm labor by members of the family would have cost about $58 if it had been hired. The farmer really earned as his wages $423. This we call his labor income. Hired men in this region get about $360, house rent and some farm products. If a farmer's labor income is less than this he might as well lend his money and hire out.

About one-third of the farmers in Tompkins County are making less than hired men's wages; one-third are making wages; and one-third make more than wages.

Table 2 shows the same results for Livingston County. The region is a very prosperous one and gives an average labor income of $584.

TABLE 2. — *Averages, Livingston County.*

Number of farms,	574
Average capital,	$10,548
Average receipts,	2,172
Average business expenses,	980
Receipts less expenses,	1,192
Interest at 5 per cent,	527
Income from unpaid labor,	665
Value of unpaid labor except owner's,	81
Labor income,	584

Most Important Factors affecting Profits.

The four most important factors affecting profits have been found to be size of business, crop yields, production per cow or other animals, and diversity of the business. So strikingly do these four factors stand out that if we know them we can guess the labor income with approximate accuracy in about 95 per cent of the cases. Only in a few cases do practical farmers make other mistakes of so serious a nature as to prevent them from getting a good labor income when these four factors are favorable.

Farms not balanced. — Farmers are like other people, — they have hobbies. There is practically no relationship between good cows and good crops, or between size of the farm and production of crops or cows. We find that the farmers who have the best cows average very little above their neighbors in crop yields. That the crops are good gives no indication of whether the cows are good or bad. On the average, there is practically no relation either between the size of the farm and quality of the crops or cows. As a result we have all kinds of combinations of the factors of profits. There are very few farms that rank well in each of the four respects.

Size of Business. — There are many ways in which the size of the business may be measured. Farms may be compared on number of days of work done, number of men kept, amount of capital invested, number of cows or other animals kept, number of work animals, number of acres of land, or acres of crops grown. So long as we are dealing with fairly uniform conditions each of these comparisons will give about the same results as an average of large numbers; but when a particular farm is considered it may be placed in a different class when the method of sorting is changed.

Relation of Capital to Profits. — Tables 3, 4, 5 and 6 show the relation of capital to profits. The farmers in either of these counties who do not have a capital of at least $5,000 are not doing as well as hired men. In Tompkins

TABLE 3. — *Relation of Capital to Profits on 615 Farms operated by Owners, Tompkins County, N. Y.*

Capital.	Number of Farms.	Average Labor Income.
$2,000 or less,	36	$192
$2,001 to $4,000,	200	240
$4,001 to $6,000,	183	399
$6,001 to $8,000,	94	530
$8,001 to $10,000,	45	639
$10,001 to $15,000,	44	870
Over $15,000,	13	1,164

County over one-third of the farmers had less than $4,000 capital, but not one of these made a labor income of $1,000. About two-fifths of the men with $10,000 capital made over $1,000 labor income. The figures for all the other regions show the same results.

TABLE 4. — *Comparison of Profits on Same 615 Farms.*

Capital.	Number of Farmers.	Per Cent of the Farmers making Labor Incomes of Over $1,000.
$2,000 or less,	36	–
$2,001 to $4,000,	200	–
$4,001 to $6,000,	183	8
$6,001 to $8,000,	94	14
$8,001 to $10,000,	45	22
$10,001 to $15,000,	44	32
Over $15,000,	13	46

TABLE 5. — *Relation of Capital to Labor Income on 578 Farms, Northern Livingston County, N. Y.*

Capital.	Number of Farms.	Average Labor Income.
$5,000 or less,	87	$291
$5,001 to $7,500,	80	407
$7,501 to $10,000,	112	480
$10,001 to $15,000,	164	769
$15,001 to $20,000,	62	1,001
$20,001 to $30,000,	55	1,062
Over $30,000,	18	1,691

TABLE 6. — *Comparison of Profits on Same 578 Farms.*

Capital.	Per Cent of the Farmers making Labor Incomes of Over $1,000.
$5,000 or less,	7
$5,001 to $7,500,	11
$7,501 to $10,000,	16
$10,001 to $15,000,	33
$15,001 to $20,000,	46
$20,001 to $30,000,	51
Over $30,000,	50

Relation of Amount of Labor employed to Profits. — If we measure size of business by number of men, or total value of labor directed, we find the same comparisons. Those farmers who do not direct at least one man besides themselves do not, on the average, earn much more than farm wages. Table 7 gives such a comparison for Tompkins County, N. Y. The total value of labor directed includes the farmer's labor, estimated at $326 for the year, this being the average price that farmers estimated it would cost to hire the labor done. If the total labor directed does not equal about $650 to $700, the farm does not employ one hired man for full time besides the farmer.

TABLE 7. — *Relation of Labor to Profits.*

Value of Total Labor.	Labor Income.
$347,	$288
426,	332
557,	432
730,	534
960,	721
1,307,	1,194

Relation of Size of Farm to Profits. — A better measure of size of business is the acreage farmed, or better still, the acreage of crops grown. Tables 8 and 9 give such comparisons for general farming where hay, grain, potatoes, cabbage and apples are the usual crops, and where a considerable proportion of the farmers keep dairy cows.

TABLE 8. — *Relation of Size of Farm to Profits, 586 Farms, Tompkins County, N. Y.*

ACRES.	Number of Farms.	Average Size (Acres).	Average Tillable Area (Acres).	Labor Income.
30 or less,	30	21	18	$168
31 to 50,	108	49	38	254
51 to 100,	214	83	60	373
101 to 150,	143	124	88	436
151 to 200,	57	177	117	635
Over 200,	34	261	160	946
Average,	-	103	-	$415

TABLE 9. — *Relation of Size of Farm to Profits, 578 Farms, Livingston County, N. Y.*

ACRES FARMED.	Number of Farms.	Average Size (Acres).	Tillable Area (Acres).	Labor Income.
30 or less,	17	20	17	$54
31 to 50,	35	43	37	295
51 to 100,	147	79	64	437
101 to 150,	178	127	104	593
151 to 200,	89	175	142	934
Over 200,	112	305	241	1,082

In these regions the average farmer with less than 50 acres would make more money if he sold his farm, lent his money and hired out as a farm laborer, or better yet, became a tenant on a larger farm; or in many cases he might better go in debt for a large farm and own it.

Comparatively few farmers with less than 100 acres made very good profits. Of the 551 farmers who farmed 100 acres or less, only 6 made labor incomes of $1,500. But of 292 farmers who farmed over 150 acres, 60 made over $1,500.

Relation of Acres of Crops to Profits. — A still better way of measuring size is to compare the area of crops grown. This includes all harvested crops, but does not include pasture. Table 10 gives such a comparison.

TABLE 10. — *Relation of Acres of Crops to Labor Income.*

Acres of Crops.	Average Acres of Crops.	Number of Farms.	Labor Income.
20 or less,	14	18	$24
21 to 40,	31	55	257
41 to 60,	51	95	400
61 to 80,	69	115	481
81 to 100,	90	96	642
101 to 140,	118	112	937
Over 140,	193	88	1,261

Most of the economies in production are dependent on the area of crops grown. Five horses are enough to raise 100 to 150 acres of general farm crops when the crops consist of a good combination of grain, hay and potatoes, apples or cabbage. If the crops are of the above kinds there should be at least 20 acres per horse, but if they are hay and grain there should be at least 30 acres per horse. In the eastern States the cost of horse labor per acre is more than the interest on the value of the land. While five horses can raise 125 acres of crops it is difficult to raise 50 acres of crops with two horses. Farm machinery is built on the two, three and four-horse basis. Evidently if one has less than 80 acres of crops he must either go without good machinery or must keep too many horses. There is no other solution of the problem for him.

Machinery, horses and labor cannot be used efficiently with less than 80 to 100 acres of crops; and 200 acres is still better. The various reasons for this have been published elsewhere. For this discussion it is sufficient to see that size of business is very important and that crop acres is one of the best measures of size.

The time spent in growing even an average crop in reasonably large areas pays the highest wages of any farm work. If a farmer has a large area of crops, it not only indicates a good-sized business, but indicates that the farmer is doing a large amount of work that pays well.

Crop Yields.

Increased yield per acre is important, but not nearly so important as is usually assumed. Table 11 shows the relation of yield to labor income, when 100 per cent represents the average yield of the region.

TABLE 11. — *Relation of Crop Yields to Labor Income, 574 Farms.*

PERCENTAGE YIELD.	Average Percentage.	Number of Farms.	Labor Income.
75 or less,	67	58	$165
76 to 85,	81	60	219
86 to 95,	90	102	663
96 to 105,	101	116	570
106 to 115,	110	103	878
116 to 125,	120	66	951
Over 125,	138	69	1,090

An increased yield per acre makes the business larger, and if not carried too far is a good thing. After one secures yields of perhaps a fifth better than the neighbors *on the same soil* he must be careful that his cost per bushel for the increased crop is not more than the increase is worth. If the neighbors on the same soil get 1½ tons of hay per acre it may pay to grow 2 tons. If, under these conditions, one wishes 3 tons, it can usually be grown at less cost per ton on two acres than on one acre. This is the reason why the acres of crops have more influence on profits than does the yield per acre.

Production per Cow.

All dairy products are produced on a very close margin of profit. It is very easy to feed cows so as to lose all that one has made by raising crops. Table 12 shows the relation of receipts per cow to profits. Those farmers who get over $75 per cow are the only ones who are making good labor incomes. In this case $75 per cow indicates about 6,000 pounds of milk.

TABLE 12. — *Relation of Receipts per Cow to Profits, Tompkins County, N. Y.*

RECEIPTS PER COW.	Number of Farms.	Labor Income.
$30 or less,	18	$30
$31 to $50,	97	316
$51 to $75,	106	483
$76 to $100,	53	715
Over $100,	33	1,325

It will be seen that while farmers who get average crops are often doing very well, it takes much better than average cows to pay.

Diversity of Industry.

If a farmer raises nothing but crops he usually wastes considerable material that could be used to a profit to feed animals. If he raises animals only he spends all his time on the farm enterprise that is least likely to pay good wages. He does not get so much for his manure because a heavy application on one acre does not usually bring as good returns per ton as if spread on two acres. Nor is he so likely to keep horses and men fully employed. To care for a dozen cows is about half work for a man. One man can do this and raise the cows' feed and cash crops to sell besides. Table 13 shows such a comparison. The farmers who combine cash crops and stock make more than those who go to either extreme of specialization.

TABLE 13. — *Diversified Farming related to Profits on Farms selling Wholesale Market Milk, Livingston County, N. Y.*

PER CENT OF RECEIPTS FROM CROPS.	Number of Farms.	Average Area.	Labor Income.
15 or less,	14	209	$769
16 to 30,	28	218	1,210
31 to 50,	25	264	1,225

Table 14 shows that crop yields are less important than size of farm or production per cow. The combination of good cows and a large farm gives a better chance than good crops and good cows.

TABLE 14. — *Comparative Importance of Size, Crop Yields and Production per Cow, Jefferson County.*

	Labor Income.	Per Cent making Over $1,000 Labor Income.
All farms (670),	$609	22
97 farms (best crops, 132 per cent),	684	24
97 farms (best cows, $84+),	968	41
97 farms (largest, 224+ acres),	898	43
23 farms (best crops and cows),	994	39
11 farms (best cows and size),	1,294	73

As has been previously stated, there seems to be little relation between any of these factors. If a farmer is good in one respect it does not tell anything about the other points.

BALANCED FARMS.

Evidently a farmer who is as good as the average in every particular is very far from an average man. He is a very unusual man. In Jefferson County, out of 670 farmers, only 32 were as good as the average in each of the four respects. The average labor income of this region was $609, but the farmers who were as good as the average in size (143 acres or more), crop yields, receipts per cow ($59 or more) and in diversity (20 per cent or more from crops) made an average of $1,491, and only 6 of them failed to make as much as $1,000.

As a standard for dairy farms, we may take the average of all farmers in three regions who sold market milk and who made labor incomes of $2,000 or more. Table 15 gives these averages.

TABLE 15. — *Averages for 23 Farms selling Wholesale Market Milk (Three Counties).*

Acres,	257
Crop acres,	154
Crop index,	119
Receipts per cow (32 cows),	$98
Milk sold (pounds),	6,470
Per cent of receipts from crops,	34
Labor income,	$2,658

Our records give similar comparisons for other types of farming. But the principles of size and production hold on the truck farms and crop farms as well as on dairy farms.

INDIVIDUAL FARMS.

It is evident that we can give a very close estimate of labor income if we know the above four factors. The following examples are from Jefferson County: —

Farm 1.

Crop acres, 29; very poor.
Crop index, 208; excellent.
Receipts per cow (11 cows), $116; excellent.
Per cent of receipts from crops, 21; excellent.
Labor income, $980.

This is the best record for so small an area. It represents the top notch in the "little farm well tilled." Splendid crops, splendid cows, even on the small area, crops to sell, and all work done by the farmer himself with two months of hired labor. Such a farmer as this should be able to make $3,000 labor income if he rented land on which to grow 100 acres more of crops, doubled his number of cows, and kept two men by the year. With this system he would not have to work so hard.

Farm 2.

Crop acres, 21; very poor.
Crop index (hay, 3.3 tons; silage, 13 tons), 211; excellent.
Receipts per cow (8 cows), $90; excellent.
Per cent of receipts from crops, 22; excellent.
Hired labor, $250; poor for the size.
Labor income, $380.

This farmer kept poorer cows and hired one man, although he had so little work to do. For these reasons he made less than the owner of farm 1.

Farm 3.

Crop acres, 133; good.
Crop index (hay, 1.1 tons; oats, 25 bushels), 75; poor.
Receipts per cow (20 cows). $95; excellent.
Per cent of receipts from crops, 16; fair.
Labor income, $1,661.

This farmer gets crops only three-fourths as good as his neighbors, but with the large area he should make a good profit from growing them. He sells part, and what he feeds to cows he makes a second profit on because he gets such good returns per cow.

We should expect him to do very well indeed. His crops are only one-third as good as farms 1 and 2, but the larger area more than makes up. If the soil is as good as his neighbors he might readily bring his labor income to $2,000 by raising better crops.

Farm 4.

Crop acres, 110; excellent.
Crop index, 142; excellent.
Receipts per cow, $96; excellent.
Per cent of receipts from crops, 19; excellent.
Labor income, $2,239.

This farm is excellent in every particular. We should expect it to make at least $2,000, as it does. About the only difference from farm 3 is in crop yield.

Farm 5.

Crop acres, 109; excellent.
Crop index, 120; excellent.
Receipts per cow (32 cows), $56; poor.
Per cent of receipts from crops, 4; poor.
Labor income, minus $113.

This farmer made very good profit on his crops of which he had a good acreage. But he fed these crops to cows that did not pay their feed bill. If he had excellent cows his labor income would be $1,500, but as it is he did not even make interest on his capital. He paid for the privilege of working.

Farm 6.

Crop acres, 259; excellent.
Crop index, 134; excellent.
Receipts per cow (33 cows), $74; good.
Per cent of receipts from crops, 53; excellent.
Labor income, $3,270.

This is the highest labor income made by any farmer who sold milk at wholesale. With his unusually large area of good crops he could easily raise his labor income to $4,000 by keeping better cows.

After one has studied large numbers of records it becomes possible to tell whether the labor income is poor, good, fair or excellent by knowing these few figures. This is the final proof that these are the most important factors of profits: and it applies to other types of farming equally well. In about 5 cases out of 100 some other factor affects the results so decidedly as to make the guess wrong. But on most farms a good-sized area of crops and good yields have so strong an influence as to overshadow other factors, and almost insure good returns if the crops are sold or are fed to animals that bring good returns.

There are some city men in the audience. I may say that all this discussion is from results by practical farmers. City men are most likely to fail from putting too much money in buildings and keeping too many men, and from doing too many fancy things that are called scientific farming, but that are really "folly farming." Experienced farmers do not often make serious mistakes in these things.

A Farmer's Catechism.

Each farmer will do well to compare his farm with successful farms, to see where it is weak and whether it can be improved, by asking himself these questions: —

Have I 80 to 200 acres of crops? If not, can I buy or rent more land?

Are my crop yields 10 to 20 per cent better than my neighbors' who have the same soil? If not, will it not pay to improve them?

Are my cows at least 50 per cent better than my neighbors'? If not, how much am I losing on them per year? Had I best stop keeping cows, or get better ones?

Am I getting at least 20 per cent of my receipts from the sale of cash crops? If not, could I make more by raising cash crops?

Am I getting at least 20 per cent of my money from animal products? If not, am I making good use of low-grade farm products, and am I and my horses kept well employed most of the year?

QUESTION. Is that $11,000 you showed on the slide the actual capital, the equity?

Professor WARREN. No, it is the total capital, the value of the investment. The average mortgage, deducted from this, gives you what the farmer owns. The average is something like $2,000; still, it doesn't make a different figure. Suppose the farmer is in debt for all his capital, he would pay this interest; if he was in debt for none of it, he pays it to himself, you see.

QUESTION. (Following slide showing increased output per man, but not increased output per horse.) Isn't that due to improved machinery?

Professor WARREN. An improved driver and improved machinery, yes, but here is the thing: a lot of men here probably remember when you never cultivated anything with more than one horse, and now a lot of you use a two-horse cultivator and do almost twice as much per man. A good many can remember when you always plowed using two horses, and then you commenced to plow with three, and some with four, and the further west you get the more you find. The result is more crops raised per man, but the horse isn't doing any more. Even with four horses and one driver you won't get any more work than if you had two men driving two horses apiece, but the man is doing more. You find the same thing all the way through; take, for instance, the mowing machine. I know of a farm of which I happen to have photographs of three generations of mowing machines, — a 4-foot, 5-foot and an 8-foot, — and the 8-foot draws easier than any of the others, tires the horses less, also, because the 4-foot machine was built when the horses had to draw a mowing machine that went northeast when you went northwest. That is economy, — a straight improvement in machinery. So, all the way through farmers are getting to use more horsepower; and a horse, properly directed, is equal to ten men.

QUESTION. Are you willing to admit that on a good many farms it would require three horses to plow what two would do on another farm?

Professor WARREN. Certainly, certainly; but per man it holds just the same. If the driver is driving two on that farm, or three, and somebody else is driving one, he will plow more acres per man, but not any more per horse, ordinarily.

QUESTION. Can you compare the records of one man keeping 20 cows and selling cream, and another keeping 20 cows and selling milk?

Professor WARREN. I had those slides, but I left them in the hotel because I didn't want to mix this subject up. Market milk pays considerably better than any other dairy product. You have the same cost for dairying with market milk that you do with the other.

QUESTION. At what rate per quart?

Professor WARREN. At the rate we get in New York State in any county, and in Massachusetts it will be more emphatic, because you don't get for your butter proportionately more than you do for your milk. I am more in favor of market milk in this State than with us, because you make more on your milk than you do on your butter. You don't get any more than they do in Illinois for butter, unless you retail it.

Mr. R. H. RACE. I would like to know what is the practical application of this morning's address. Are we going to stay on the farm, or hire out for $60 a month?

Professor WARREN. You are not going to get into the $60 class, but unless you are going to make more than $60 you had better not stay on the farm, because you are worth more than that in the world. The practical application is to have enough acres so that you are going to get enough crops to keep your horses busy. Now, one-half of the farmers in America rent all their land; that is one way. Another way is, suppose you own some land and not enough, you can rent some of your neighbor; and one-fifth of the farmers in America do that. Another way: there are just lots of farmers, good farmers, who would be benefited, particularly if they are young men, if they would dare to go in debt and buy some land near them. Still another way is not to buy at first the land for farming, but to be a tenant long enough until you get money ahead. Be a hired man until you get money enough to buy a lame horse or two or three, and don't change too soon from a hired man to an owner. Be a tenant until you have got money enough to buy two or three acres of some man, and then you can buy that and rent some more; and you can do that little trick of throwing the hay over onto yours without taking the manure back, and that is usually done. [Laughter.] It isn't necessary to have all the money in the United States to get into farming that way. The man who has $2,000 can be a tenant on a big farm and do a big business and beat the men with a little patch all to pieces. Another way is, if you have got good enough land, to make the business pay on the same acreage by going into trucking; but don't all raise truck. There is enough produced in Massachusetts now to supply most of the people, and you know what happens to truck crop prices when you get too much. Don't do it unless you have got good land.

Now, about the cows. You have got to buy them because you don't raise them much in this State. You can't afford to feed 4-cent milk to calves unless you are fairly sure you will some day get the money back. You can raise some cows, but be critical; don't raise a calf merely because it is a heifer. Raise only the very cream of them.

Now, as to crops, you don't need to get a double crop yield. If you get 25 per cent better than your neighbor, you are going to do pretty well.

Those are the practical applications, it seems to me, and if you give me those figures, those four factors I spoke about, I can tell you, practically, how much money you will make, and perhaps tell you where the weak point is. Now, there isn't much satisfaction in going out and making that $2 a month on a farm just because some newspaper has said it is a good thing to get back to the land and hear the robins sing. There is no pleasure in hearing a robin sing when you are getting only $2 a month and your wages.

Mr. POTTER. I don't quite understand what the method is of making comparisons between large and small farms. For instance, do you go along a road and pick out a good large farm and then go along and pick out a small one? It doesn't seem to me that you get a fair comparison between the large and the small.

Professor WARREN. We take absolutely every farm in a section, and that is the only fair comparison. That is a question which we have to answer daily. We take absolutely every farm, good and bad, big and little, and have made the figures from all of them.

Mr. POTTER. That is what I didn't understand. I thought you said 600 farms.

Professor WARREN. Well, those are all within that region; those are all the farms operated by their owners. I didn't put the tenant farmers in that slide, because I didn't want to confuse you. We find, of course, great variations. But what is the limit? Why, to move up a step better, you don't need a million acres. A farm of 200 acres, with 100 in crops, or 300 acres with 150 acres in crops, is a good farm; but when you get down to less than 80 acres of crops you have got to figure some to find a fair profit.

Mr. WILDER. Did you find those figures all prepared, or did you have to do some preliminary work in getting them?

Professor WARREN. We get them by asking the farmer all his sales. It takes about a quarter of a day to get them on each farm, on the average, and I feel that we get them with a great degree of accuracy because of the way in which we ask. If we ask a farmer what his receipts are, he doesn't know, but if we say, "How much did you get for your milk?" he is probably able to tell; then we check it up by going to the creamery and seeing if his method is accurate. If we ask him for his total expenses, he doesn't always know, but if I say, "How much did you spend for horseshoeing?" his wife will be right around there to jog his memory, you bet, and you will get pretty close to it. We say, "How much was your threshing bill?" and we get that, because he knows he had so many oats, and so forth, and he gives us the yield and we know there is so much oats, and at so much a bushel, and we get the threshing bill in that way, and so we can check it right straight along, and check up all the points, because we know most of these things. Then we have the cost accounts on a good many farms which help us. Then you can ask him his yield in hay and you can judge by the barn capacity whether he overestimated it or not. Then, you see, these conclusions are very sweeping. When a man gets $3 and another $3 and another $3, right straight through, and one fellow overestimates a couple of dollars on his horseshoeing bill, you see it doesn't make any great difference in the end.

Mr. Race. Now, the speaker discourages buying a farm and starting in with a small field, but a man hasn't any courage to work for a home on a hired farm. The farm should have a home value. Then he hasn't said anything about the boys who leave home, the best of them, who leave their fathers on the farms that aren't good enough for them to do farming on. I was talking with a big milk dealer in Port Chester, a suburb of New York, the other day, and he said he owned a farm in Egremont on which he had 30 cows, and he says to me, "I have sold the milk from those cows and I have got the money to show; it was $4,000 last season." He hired a man, a boss farmer. He doesn't do any work on his farm, but the boss farmer is working it, doing work for another man. He says to me, "I have got too big a farm. I have 130 acres and we have got to come to a smaller farm." Now, that is true; we have got to come to the smaller farm to get the boys that have gone away to come back to the farm. The boys want to go to the city where they get the salaries. We only produce 7 per cent more in this county than we consume all told; that is what the State Board of Agriculture put out, and we are getting down pretty close. If we should have a famine we should have to go to Russia to get something to eat. A fellow goes to the city and gets $60 or $70 a month, pays $30 for house rent, and all things, and where is his money? The cashier of a bank in Great Barrington said the other day something which I want to repeat to you. I said to him, "Who are your depositors in your bank? Who are the most reliable? Where does the most money come from that you can depend on? He says, "The farmers." "How about the business men?" And he says, "They overdraw their accounts every month."

Professor WARREN. Perhaps we had better turn it around the other way, about boys leaving the farm. We have studied this thing, and it isn't all hot air, as it is in the papers. We went to every farmhouse and said, "How many children have you?" We asked them, "What is each child doing?" We got the occupation of the daughters, the husbands, the sons, found what they were doing, and found that 82 per cent of the sons were staying on the larger farms of 200 acres and over. I don't remember the exact percentage on the small farms, but it was about 29 per cent. The sons will not stay on the small farms where there is nothing for them to do.

Mr. RACE. Then a man had better buy a farm right side of his and put the boy on it.

Professor WARREN. That is business. [Laughter and applause.] Suppose you have got 8 cows and 15 acres of hay and a little corn silage and a little oats and have got four sons and, of course, you aren't dead yet yourself —

Mr. RACE. Then I would have four farms right around there and work them between the four sons.

Professor WARREN. And *that* is business, too; and then you get your 200 acres. [Applause.] The little farm business is a question of whether you are going to starve to death or not. The crop yield per acre on the large farm is as good, or better, than on the small. Furthermore, on the small farm the horse eats up about all it earns, and there is nothing much left. The 200-acre farms are contributing much more per acre for human food as a surplus to sell than the small ones. If a horse cuts 5 acres of hay, he eats the whole thing up, pretty nearly, but when a horse is farming 30 acres of crops, perhaps 10 or 15 of that will be hay, — and it runs more than that in New England, — and then he doesn't eat it all. The yield per acre is better on the larger farms, or just as good, and since there are fewer horses per acre, they don't eat it all up, and the larger also contributes more to human food. Now, if you want to get to the bottom end of nowhere, just take, for example, Russia, or go further, to China, and see what they are doing there. Professor Gilmore, who has worked over there, says their greatest problem is the lack of men. They can't build railroads because every man has to work on the farm to keep himself. Each gets his little bit of a farm, and manages to scratch out a bare living for himself; he doesn't have anything to sell to feed the fellows who build the railroads. You have got to have a smaller and smaller percentage of our population on the soil, or civilization stops. With 100 per cent farmers we have no civilization; and the smaller the percentage of farmers, the higher the civilization. In America one man raises food enough to feed five families, while in China three men raise only enough to feed four families, and so they haven't men enough to build their railroads. They have got to open up Manchuria and get some farms big enough so that one man will raise enough to feed two or three, and until they can release men from those little truck patches they won't be building any railroads.

Oh, I had forgotten. There was that other question of Mr. Race's in regard to home value. The figures I am giving you are what the farmer gets for his labor. If he does not have any other source of income than the farm he must get a reasonable wage before he can have much of a home value there. The farmers who don't get more than $2 a day for wages, besides interest on their capital, are not living in a home that is very valuable, and the sons aren't impressed with the desirability of that sort of home. We have got to have a reasonable income, and your little farm doesn't give it. I showed you one of 11 acres, but that is a muck patch.

You can't get such results up on the granite hillside with 11 acres. I believe, though, that the little farm is going to do great things for the city worker; not the millionaire who has a big place, but the small worker in the factory. I believe we are going to get the factories out into the smaller towns, where the employees can live near the town and have truck patches; where they can earn a part of their support, and raise children and crops while at work in the factories. I believe most thoroughly in every city worker, who can, living on a farm. That is the home question. He has another source of income, and he doesn't have to sell anything from his farm. It makes a good place where he can bring up his children. But of course that isn't farming. Farming is taking land and out of that land creating enough money income so that you can educate your children, and so that you can have reading matter in your home, and music in your home if you want it. That takes a reasonable wage, and I have shown you this morning the four most important factors in making that reasonable wage. Farming is not a bad business; it is a good business if you like it and if you have got the thing organized on a reasonable basis.

Now, I have not tried to compare farming with city occupations. I have compared farming with farming to show how to make one farm pay as well as the next pays, whether either is good, bad or indifferent; that isn't the subject this morning. When you try to compare farming with city wages you have got a pretty complicated problem, which we have no time to discuss this morning.

Mr. Worth. Now, before any questions are asked, Mr. P. M. Harwood would like to make a statement while the gentlemen are all here.

"PROTECTION FROM FLIES" CONTEST.

MR. P. M. HARWOOD.

Yesterday I promised that if I could I would obtain from the office and read to you what we had written in relation to the "protection from flies" contest. Perhaps I ought to say, for the benefit of those who were not here yesterday, that the State of Massachusetts has offered sums of money not to exceed $5,000 per year for three consecutive years for the encouragement of dairying. Only one-fifth of what was asked for was granted us. We have aimed at two points: one, to encourage clean milk, — the production of clean milk in the pails before it is strained; therefore prizes were offered totaling $2,100 for milk which appeared to be the cleanest. We have also awarded prizes for dairies protected from flies. Now, if we can induce dairymen to be more cleanly in their methods of milking, keeping the dirt out and keeping the flies out, we think we have accomplished a good deal, and we think that a better way than penalizing people for not doing what they should do is to encourage them by giving prizes for doing better. Nothing has appealed to me since I came to this meeting as have the words of many of the unsuccessful contestants (114 being the total number, only 20 of whom could be successful), who have told me that they will try again if they have an opportunity; they say that they have learned more in this contest about the production of clean milk than they ever knew before in all their experience of years in dairying. This is encouraging.

I want to say just a word about taking advantage of the psychological moment. Mr. Kenneth E. Webb, winner of the second prize in the eastern section, was here yesterday

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BREEDING AND FEEDING DAIRY CATTLE.

By F. E. Duffy.

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BREEDING AND FEEDING DAIRY CATTLE.

MR. F. E. DUFFY, WEST HARTFORD, CONN.

May the day soon come when no man who does not love the dairy cow shall feed or breed her. I use the word "love" advisedly. The good breeder to my mind is the one who joys to minister to her wants, delights in her presence during his waking hours, goes to his rest to dream of a more perfect dairy type of his breed yet to be, and if he is a praying man, the prayer of his heart will be that the dairy cow which he breeds may more nearly approximate perfection.

I say that every breeder of dairy cattle should love his particular breed and should recognize it as his life work to perfect the type or ideal of that breed. May his love be as great and his discretion greater than that of an old Scotchman whom I once knew, who was never profane unless the transcendent qualities of his well-loved "Ayrshire coos" were called in question. He declared that when a man in Scotland rented land, if he was wise in agriculture he would buy a "bunch" of "Ayrshire coos," and if he breeds them "well for a ten year" he could pay for his farm; and if he keeps the increase "well for five year more" he could buy his neighbor's farm; and if he learned his business and "tended his coos well until he was fifty year old" he could buy every farm that joined him.

How much of this description was born of the Scotchman's enthusiasm I must leave you to judge. But this I know, that on a beautiful May day in the 90's I was present at a sale of his dairy cattle, and the best breeders of Ayrshires in the country had traveled many a weary mile to this farm in the back country at Hemmingford, Quebec. The farm was six miles from a railroad, and yet this herd was sold to these breeders for three times the amount that Mr. Clellan was able to get for his farm. I have cited this instance, and I might cite numberless like ones, as a proof of a position that I am about to take that is not eagerly assented to in New England. It is this: that breeding registered dairy cattle of any of the four dairy breeds is the most profitable kind of dairying for 90 per cent of the people engaged in the dairy industry in New England. I except the men who make market milk and who live in close proximity to our cities. But I am inclined to the opinion that even they might be included and the truth of the proposition still be verified. In attempting to substantiate this statement I shall try to cover the whole scope of my subject. Whether I will or no I must invite the young men of the rural communities to engage in breeding and feeding the dairy cow.

Is it worth while? Is there anything in this constant babbling about back to the land and keeping the young people on the farm? Something, perhaps; but its importance has been greatly exaggerated. There are enough agricultural products, and especially dairy products, produced already to meet every reasonable demand. In the beginning this country was populated practically by farmers alone, but as inventions have aided the farmer he has been able to dispense with much manual labor, until to-day 60 per cent of the population dwell in the cities and only 40 per cent on the farm. As inventions continue to multiply, and they certainly will, less and less people proportionally will be required on the farm.

This is as it should be. What needs to be remedied is extortionate transportation charges and the excessive costs of distribution. The city papers should teach their readers that the agricultural industry is the only industry in this country that is on a strictly competitive basis. Farming is the only industry in the country that welcomes every comer to its ranks, the city editor included, and furnishes them with all the instruction at its command to compete with us and to help lower the cost of our products. If the "back to the land" propaganda could be carried out it would bring about another agricultural depression in prices and another exodus of country people to the cities; and so on *ad infinitum*. I do not believe we are in any great danger of such a repetition of history. American lands are nearly developed, and the population of our cities will continue to increase much faster than the farming population. Furthermore, whether or no agriculture is to become a profession, it is rapidly being divided into distinct branches, and each branch to be carried on effectively requires a high degree of intelligence and skill. As the years go by the intelligence and training given by the schools and the skill obtained by practice will receive greater and greater rewards.

Herein is your opportunity, young man. You will be paid according to the intelligence, training and skill you acquire in breeding and feeding dairy cattle, and if you possess these attributes in a high degree your reward will compare favorably to that to be had in any other industry.

But you say: What about the teachings of our "modern" agricultural papers, that are so glibly reciting that success can be insured by using a few well-meant recipes of how to conduct a farm according to the rules of scientific agriculture as laid down in their columns? I have this to say about their teachings, that they are mostly prepared by newspaper reporters out of a job. Their reports of profits of men who merely take up agriculture as a pastime are truly wonderful. These reports and their wonderful figures bring to mind the dictum of Carroll D. Wright: "While figures will not lie, liars will figure." Nor is this type of agricultural paper the only agency that is deceiving the people in this respect. This country is spending large sums of money collecting statistics that remind one of D'Israeli's saying that "There are lies, damn lies, and statistics." We have also officials in this country who from these figures draw equally unusual conclusions. A very distinguished official recently "demonstrated" by such figures that in the course of the advance in prices in this country the farmer had reaped a reward out of all proportion to that of the man engaged in any other industry. To prove his statement he cited the profits of raising corn. He stated that the value of an acre of corn, including forage, was $16, and proved by his figures that 25 per cent of this was net profit, leaving $12 as the expense of raising the crop. Now it is a fact that an acre of corn of the weights given by him depletes the soil of $12 worth of fertility.

I have taken so much of your time to correct the common error of to-day in many quarters in underestimating the importance, and the possible profits, of the breeding of dairy cattle. The breeding of registered dairy cattle, if done skillfully and intelligently, is the most profitable kind of dairy husbandry. It is a business requiring skill and intelligence of that order that is possessed by the New England farm boy who has learned how to do well every task on one of these little four or five cow hill farms. I would have him possess a good common school education in addition to his farm education, and besides that all the higher education he can get, providing it can be done in a reasonable time and does not estrange him from the cow and her care. Every breeder should read the agricultural papers, especially the dairy press, and without fail he must study the breed paper of his dairy breed. He should get in as close touch as possible with the agricultural college in his State. The best dairy man that I have ever known received his inspiration for work from a six weeks' course in dairying. He should be a member of the Dairymen's Association of his State, also of the Jersey, Holstein, Guernsey or Ayrshire associations.

I would recommend VanPelt's "Cow Demonstration" for a handbook, and Davenport's "Principles of Breeding" for a textbook, on breeding. He should also spend an hour each day reading the best English authors on breeding dairy cattle. He must possess skill in judging the dairy cow, and to get it should see and study every great dairy cow of his breed within one hundred miles of his home. He must know his score card and be able to see the fault or merit of each particular organ. That such a life work is a delightful one all may admit; but what about the fellow who says it won't pay? It is paying on tens of thousands of dairy farms in America to-day.

It pays even if only the increased value of the dairy product is considered. In my own experience in breeding in eight years I was enabled to increase the dairy product of my herd 33⅓ per cent, and to increase the price of that product as well. One breeder in Connecticut has sold $10,000 worth of stock during the last year from a farm of 150 acres. Now, my boy, if you go at this business right and select a good woman as your partner (using the greatest precaution in her selection, for you will never make a more important one), you may be assured of a just return for your labor. The New England dairymen who are raising registered cattle as a part of their dairy enterprise are the only dairymen in New England that are receiving the profit that they should from their business.

If a young man and his wise counsellor are about to make their first investment in registered dairy stock, how shall it be done? If the education that I have outlined has been neglected, then they are poorly equipped for this task. The prime requisite in a breeding herd is a good bull; and great bulls are sons of great mothers. So the buyer must know the mother, and if possible the grand dams; and much care should be given in studying these matrons. Skill in selecting good dairy cows can be acquired by any New England boy of a good common school education who will put his best energies into the work. Selection of the bull is the greatest factor in building up the dairy herd; but the judging of the dam of the bull must precede the examination of the bull himself.

The best method of studying the dairy cow is to study the cow herself. Get a thorough understanding of the score card; get a course in an agricultural college if possible; get all the help you can from dairy papers, bulletins and books on breeding; but with all your getting, get a thorough knowledge of that particular cow. Study a good cow at every opportunity, and if the opportunity does not present itself often enough, make opportunities by visiting the best herds in the country. This must be field work. Any discussion of the subject can only be suggestive.

This afternoon we will briefly touch upon five points: the indications of constitution, of capacity, of nervous temperament, of blood circulation and of ability to produce. Constitution is indicated by the large open nostril, large windpipe, depth from the top of the shoulder to the floor of the chest, and breadth of chest. These indications must be possessed by the cows close up in our bull's pedigree if he is to be the progenitor of a great herd of dairy animals. The mother of our bull, and the grandmothers as well, must have capacity to digest large quantities of food without destroying their future usefulness. It is not enough to know that these cows have done a good year's work, but that they are able to repeat the performance for a period of years. She should have a large mouth, and, what is of equal importance, width, depth and strength of jaw. She should have a long, broad, deep barrel, though length is not of as great importance as breadth and depth. She should have broad, flat, well-sprung ribs; but more important than these is that indefinable thing that judges call quality; and here, the eye failing, the judge of the dairy cow must determine by the feel of the texture of the hide and hair whether the cow has strength and efficiency to properly digest her food.

The cow must have a strong nervous temperament also if she is to digest her food well and secrete the milk necessary to make her a profitable animal. The large, bright, prominent, placid eye, and the intelligent expression indicate this type of nervous temperament. The spinal processes should be open and free from fat, not large but sharp and clean cut. The hips and ribs should also be free from fat, sharp and well defined. This matter of nervous temperament must not be slighted. Sit around and watch her for a half an hour if you are thinking of buying her. See that she is ever at her work and is not easily disturbed.

The mammary veins and milk wells are the best indications of a strong circulation. The veins should be long, large and as tortuous as may be. If they enter the abdomen through many milk wells so much the better. The milk wells should be large and clean cut. Study well also the udder and its attachment. Insist on the large, broad, spherical udder running way to the front and attached high in the rear and level on the bottom. Avoid the pendant and tilted udders. The thigh must be thin and incurving, to give room for that breadth of udder so necessary to secure the requisite size. You should see the cow milked to make sure that the udder is entirely free from hard fatty tissue, and that the quality and texture is all that is to be desired. In brief, the udder should be uniform and symmetrical, spherical, and the quarters smoothly joined, with four easily milked teats of good size. Do not forget to demand the size, and remember that the udder cannot be attached too high in the rear, have too great breadth, or run too far to the front. If the mother of the bull possesses all these qualities in a marked degree she should be a comely matron; and if she has grace and beauty she is worthy to be the mother of our bull. Possibly we might excuse the grand dams if they were only fairly good in some of these points, but any marked weakness in any one of them should be sufficient to cause us to reject the bull himself and look further for our dairy sire.

The pedigree of the bull being satisfactory, what shall we demand of the animal himself? He should possess the refinement and form of the dairy cow as far as is consistent with a strong masculinity, but do not let us confuse ugliness or beefiness with masculinity. He should have all the indications of constitution, capacity, strong nervous temperament, well-marked mammary veins and milk wells, with as large and well-placed rudimentaries as it is possible to get. He should possess majesty, beauty, power and be every inch a king. I have not mentioned the sire and grandsires, because I should be inclined to greater leniency in judging them than in judging the cows. But I should require of them the same general type sought for in my dairy sire.

Having selected my herd bull, I would next look for the females to mate with him. I would, if possible, select two or more registered cows or heifers, animals possessing constitution, capacity, nervous temperament, and the indications of circulation and ability even if heifers, for these qualities are stamped on the calf if possessed in a strong degree. And above all things see to it that your heifers or cows are sired by a great bull, as the daughters of a sire inherit his excellencies or defects with almost unfailing accuracy. If my capital were limited (and the breeders on small farms whom

I am most interested in will have a small capital to commence on) I would secure ten, twenty or thirty good grades of big capacity and ability, with all the other points of excellence that grades can be found to possess. I would keep ten or twenty cows, and so on, increasing by tens, as these are the numbers that one or two or more men can economically care for. Having selected or retained a herd of cattle (for many times it is much better to retain grades of known profitable production rather than to risk the hazards of purchase) it is now necessary to consider from a broader standpoint how to establish a registered herd of the best quality.

We must remember that a great producing animal is the product of the three factors of wise selection, good environment and skillful feeding. It is folly to attempt to breed a great herd of cattle without a good cow home to put them in. Sunlight and pure air are as free as the grace of God, and they are necessary to the uplift of the bovine family. The laws of Connecticut, and I doubt not of Massachusetts, are stringent in requiring the access of light and also as to providing good ventilation, but in Connecticut the laws to secure ventilation are not so well worked out. But if our herd is to be healthy and productive our stable must be well ventilated and free from odors. The King system of ventilation is best. It is simple, cheap and can be put into any stable. Muslin ventilation comes next. Every stable should be as well lighted as the living room of the family.

The old farm stable can be made comfortable and sanitary, but if we have skillfully selected our herd it will pay for a better one as the years pass. The good dairy cow should be well fed from the day she is born until she has finished her life work. I leave the calf with the cow for five days, until the mother's milk is fit for use. I then give 1 quart of milk, diluted with 1 pint of water, three times daily for five more days, and then feed 2 quarts of milk so diluted morning and evening for three weeks; and during the next week skim milk is substituted for the whole milk. For the first three or four feeds I sweeten the milk with 2 tablespoonfuls of granulated sugar, so that the calf may more readily learn to drink. The calf should be given grain and hay as soon as it will take them, and should have all it will take of these until it is a year old. The hay should be rowen or early cut fine hay, preferably clover, or alfalfa after the calf is six months old. For the next six months the heifer should consume a large quantity of good hay and 4 pounds of grain per day, if not on excellent pasture. There are many excellent mixtures of grain. We are using a mixture of cornmeal and bran, each one part, and dry grains, two parts, for feeding our young stock.

If bred to freshen, at two years of age, the heifer should have an increase of grain after she is eighteen months old. I gradually increase the grain from 4 to 8 pounds up to ten days before calving. If there is any sign of caked udder or fever I give a pound of Epsom salts three or four days before calving. I use the same treatment for cows about to calve.

Remember that the heifer carrying her first calf should have all the feed she needs, and of a highly nitrogenous nature. For this reason I would use silage only once a day, but would prefer beet pulp or roots. The hay should be clover or alfalfa if obtainable, but if not, early cut, fine hay should be fed a growing heifer, calf or dairy cow. The quality of a dairyman or breeder may be very accurately rated by the quality of the hay that he feeds.

Hay for a dairy herd should be stored by July 10, and preferably by July 4. Hay stored later should only be used to feed horses or oxen. I hesitate to discuss the feeding of the milch cow, as in our State, at least, there seems to be such a wide belief in a few simple glib rules that do work fairly well, and if taken at their true value would really be of considerable aid in feeding. A cow in my opinion can no more be fed by rule than can a man. The balanced ration, the number of pounds of grain to the number of pounds of milk, when, and how to feed, all are matters that admit of such variations as the skillful feeder only can apply. I shall offer no dairy rations, but I shall say that the feeder who cannot prepare a balanced ration at a moment's notice is ill fitted for his work, and furthermore the feeder who will not change the composition of the ration as the cow indicates the need of a change, by putting on flesh or losing flesh, has not acquired that skill in feeding that might be his for a reasonable effort. In a word, learn all the rules of feeding you may, but always test them out on the cow. If the evidence given by the cow contradicts the rule, believe the cow, every time. The skilled eye and hand of the successful breeder and feeder is the thing to be sought, with sufficient knowledge of the nutrients as an aid in the selection of feeds. One point on which all skillful feeders will agree is that the value in feeding of a good quality of coarse forage cannot be overestimated. Grain cannot take the place of early cut, well cured alfalfa, clover, or rowen hay, and the quality and curing of silage is of almost as much importance; while roots, especially beets, tone up the digestive organs to do their most effective work.

My experience is that the narrow ration is the more efficient, but an easily digested carbohydrate is added frequently, and if good results are obtained it is retained for a few weeks and then withdrawn and the consequences watched. During extreme cold weather a quart of hominy or cornmeal can be added to advantage and then dropped when the weather moderates. The hair and hide of the cow are the first index of overfeeding. The skillful feeder notes his cow and prevents a breakdown. Henry, on "Feeds and Feeding," should be the feeder's textbook, and he should read the best dairy papers.

If our young breeder will care for his registered bull and females, study their needs and retain their increase, adding to them another heifer or two as he is able; will study and reflect on their care, and, as Josh Billings has said, emulate the merits of a postage stamp in sticking to one thing, he will live to bless the day that he began to breed registered dairy cattle.

Mr. F. A. Judith. I would like to ask if a dairyman can afford to pay $27 a ton for alfalfa when he can buy fair mixed hay for $20.

Mr. Duffy. Well, that depends on what you call fair mixed hay. Was it cut by the 20th of June?

Mr. Judith. Yes. Our hay is cut in good season; that is, it is cut along the latter part of June, perhaps the middle to the latter part. It consists of clover, timothy and red top.

Mr. Duffy. Well, now, that of course would depend altogether on the quality of the hay, and I wouldn't want to say offhand I wouldn't buy it, but I actually believe from my experience to-day that if I had some corking good cows I could afford to buy the alfalfa. I still believe that I have stood in my own light when I would not buy beet pulp and sell timothy. I had one of the best fields of clover two years ago I ever raised, and for some unknown reason it was filled with alsike, but I have taken it out and am feeding alfalfa, and I know I am doing the right thing and I am getting big returns. I wouldn't dare to feed that hay.

Now, about ten days after we got through haying at my farm, a friend of mine invited me down to Storrs. It was around the 25th of July; we went from Hartford in an automobile to Storrs, and I was perfectly astounded to see the dairymen along the road putting in hay to feed their dairy cattle. Why, they couldn't expect to succeed. They have no right to succeed and don't succeed.

Now, people say dairying doesn't pay, and they are trying to find out what is the reason. Well, there are men who are making dairying pay, even at the prices for market milk in Boston and Hartford; men are making money producing milk of that kind; but there are also others who are not. The men who are making the money are the men who are working along the right line, in that and every special line of agriculture. In Connecticut they are making money, but they know how to do the thing and do it right, and the fellow who is kicking and says he can't make it pay has got to think it over and change his method.

Mr. Lee. I would like to ask about beet pulp. Do you shorten your grain ration? Do you feed the pulp wet?

Mr. Duffy. Feed it wet, and do not shorten the grain ration very much.

Mr. Lee. It is rather expensive, but mighty good.

Mr. Duffy. When you get $400 or $500 worth of milk by feeding it, what do you care? If you can increase your yield, what difference does it make?

Mr. Lee. That is true.

Mr. Duffy. I don't believe that makes any difference so long as you can increase the product for the average cow from 15 to 25 per cent, if you have got the right kind of cow.

Question. How much beet pulp do you feed in a day?

Mr. Duffy. Not over 5 or 6 pounds, and when you begin to feed silage, not over 3 or 4.

Professor Brooks. Mr. Chairman, I want to emphasize, if I may, what the speaker has said concerning the importance of good, fine, mixed hay, like clover. Many of you have been on the grounds of the Agricultural College in Amherst. We have about 30 acres, which is really part of our campus. We do not like to break it up on account of its proximity to the college buildings, so it has been kept permanently in grass, without being plowed, for about thirty years. It is top dressed with fertilizer and does admirably. The prevailing species are Kentucky blue grass, white clover, red clover, fescue and some orchard grass, no doubt a little timothy. That land produces usually about 2 tons of hay to the acre. We mean to cut it every year before Commencement, which is about the 20th of June. In successful seasons, favorable seasons, that is, with well-distributed and sufficient rains, the white clover is sometimes at the level of my knees. I have never seen so tall and so luxuriant white clover elsewhere.

Now, we have had a good deal of experience in feeding this hay to dairy cows, in comparison with other hays, not excepting alfalfa, and Mr. Forestall, whom many of you know, and who is a good judge of dairy cows and a good feeder, told me that whenever he changed from alfalfa to the hay from these old mowings, he noted an increase in the milk; and Dr. Ramsey, whom many of you know by reputation, has told me more than once that he would get about 3 pints of milk per cow more when feeding this hay than when feeding an ordinary mixture of timothy, red top and clover. I don't wish anything that I say to influence any of you against growing alfalfa. It is a splendid crop, which we ought to grow wherever we can, but we should not forget that our own familiar grasses and white clover and alsike clover will give us a splendid hay which will compare very favorably with the very best of alfalfa.

Question. I would like to ask Professor Brooks what fertilizer he puts on this land.

Professor Brooks. A mixture of basic slag and sulphate of potash, about 500 pounds to the acre of the slag meal and 150 of high-grade sulphate of potash. On some parts of the mowing, in place of the high-grade sulphate, we have used low-grade sulphate on the top, 300 pounds to the acre; and in other parts, in addition to the slag meal and potash, we are using nitrate of soda in varying quantities, from 150 pounds to the acre, on some portions, to 250 pounds on others. With slag and potash in the quantities which I have indicated, and adding about 150 pounds of the nitrate of soda, we get a splendid crop with a large proportion of clover.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

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THE ARMY WORM.

By Dr. H. T. Fernald.

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

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THE ARMY WORM.

(*Heliophila unipuncta*, Haworth.)

By Dr. H. T. Fernald.

The army worm is widely distributed over the United States and from time to time causes considerable loss. Usually it is not abundant, but after a period of a dozen or more years it suddenly appears in large numbers, feeding upon various plants, and marching in armies attracts much attention. The present season has been one of its years of unusual abundance in Massachusetts, and this has led to many inquiries about the insect, its habits, methods of control and the chances that it may reappear another year. These inquiries have led to the publication of this paper.

History.

Records of previous years of abundance of the army worm in Massachusetts are not as complete as could be desired. Nevertheless, old diaries and journals give some evidence as to early periods of abundance in New England, which may be of interest. Flint summarizes weather and crop conditions from records from various sources. Here we learn that "the next dry summer was in 1666, when most of the grain was scorched up and the Indian corn eaten by the worms. In 1743 there were millions of devouring worms in armies, threatening to cut off every green thing. In 1770 'a very uncommon sort of worm called the canker worm ate the corn and grass all as they went above ground which cut short the crops in many places.'" As the true canker worms feed on the foliage of trees, the use of this name here is manifestly incorrect. This appearance of the insect is also recorded by Noah Webster, and in more detail by

Powers, as follows: "In the summer of 1770 this whole section of country was visited by an extraordinary calamity. . . . It was an army of worms which extended from Lancaster, New Hampshire, to Northfield in Massachusetts. They began to appear the latter part of July, 1770, and continued their ravages until September. The inhabitants denominated them the "Northern Army," as they seemed to advance from the north or northwest and pass east and south, though I do not learn that they ever passed the high lands between the Connecticut and Merrimack rivers." The caterpillar had "a stripe upon the back like black velvet; on either side a yellow stripe from end to end; and the rest of the body was brown. . . . There were fields of corn on the meadows in Haverhill and Newbury standing so thick, large and tall that in some instances it was difficult to see a man standing more than a rod in the field from the outermost row; but in ten days from the first appearance of the Northern Army nothing remained of this corn but the bare stalks! . . . About the first of September the worms suddenly disappeared. . . . In just eleven years afterward, in 1781, the same kind of worm appeared again, and the fears of the people were much excited, but they were comparatively few in number, and no one of the kind has ever been seen since." Webster states that in 1790 large numbers of army worms appeared in Connecticut and were very destructive.

In 1817 this insect appeared in Worcester County in great abundance, and again in many places in 1860 (Fitch). Fitch's report, though dated 1860 and published in 1861, contains some internal evidence that events which occurred in 1861 may have been included, and it is probable that the invasion was in the latter year, as was the case in Massachusetts and in the country at large. Round records the appearance of the army worm in 1882 in Massachusetts. The next appearance of the insect in this State was in 1894, when it was abundant in the southeastern part of the State, and in some towns in Franklin County, followed in 1896 by its general abundance throughout New England. This was the last time the insect was abundant until the present season (1914), when it has been very generally present over southeastern Massachusetts, in a number of towns north of Boston, in some parts of Worcester County, and in Longmeadow.

It should be noted that particularly in the case of some of the older records given above the absolute identity of the insects concerned with the army worm is not conclusive. The probability of their being the same, however, is so great as to leave little doubt.

The Present Invasion.

During 1914 reports of the presence of the army worm began about the 20th of July and continued until about the 10th of August. These reports were mainly from points south of Boston and east of Mansfield, and the insects appear to have been most abundant in the southern part of Plymouth County and in Barnstable, Dukes and Nantucket counties. From these reports the following list of towns in which the insect was reported has been prepared, much information on this point having been obtained by the kindness of the State Forester's office: —

Abington.
Arlington.
Athol.
Attleborough.
Barnstable.
Berkley.
Boston.
Bourne.
Braintree.
Brewster.
Brighton.
Brockton.
Carver.
Chatham.
Chelmsford.
Cohasset.
Dartmouth.
Dighton.
Duxbury.
East Bridgewater.
Easton.
Edgartown.
Fairhaven.
Fall River.
Falmouth.
Gloucester.
Halifax.
Hanover.
Hanson.
Harvard.
Harwich.
Hingham.
Holbrook.
Hyannis.
Longmeadow.
Mansfield.
Medford.
Middleborough.
Milford.
Nantucket.
Newbury.
North Andover.

Northbridge.
Norton.
Norwell.
Oak Bluffs.
Pembroke.
Plymouth.
Plympton.
Raynham.
Rochester.
Rockland.
Rockport.
Salisbury.
Scituate.
Seekonk.
Somerset.
Swansea.
Taunton.
Tisbury.
Topsfield.
Wareham.
West Boylston.
West Bridgewater.
Weymouth.
Whitman.
Worcester.

Life and Habits.

The life history of this insect varies in different parts of the country. In the south Dr. L. O. Howard considers that there may be as many as six generations a year. In New England the evidence indicates two generations, although possibly there may be but one in some portions of Massachusetts, this point not having been conclusively settled. Under these circumstances only a general outline of the life of the army worm can be given.

It appears probable that in Massachusetts these insects pass the winter as partly grown caterpillars, which resume their feeding the following spring and upon reaching full size go a few inches into the ground and there transform into dark brown pupæ (Fig. 1), in which condition they remain for two or three weeks. At the end of this period the insects have changed to moths which escape from the ground and fly at night, laying eggs for the next generation. The moths (Fig. 1) spread about an inch and a half and are rather uniformly brownish or reddish brown, with a single small white spot near the center of each fore wing above

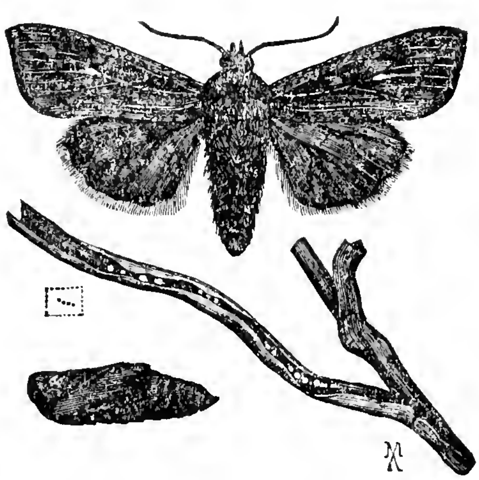

Fig. 1. — Adult army worm moth; eggs in grass sheath; pupa. (From Report of United States Department of Agriculture, 1879.)

and a small black spot near the center of each hind wing beneath.

These moths lay their eggs (Fig. 1) in rows of about twenty in a place, in the sheaths of the leaves of various grasses and grains, or on stubble, straw stacks, etc., several rows being sometimes placed on the same plant. The total number of eggs laid by a single moth is perhaps five or six hundred. These eggs probably remain a week or ten days before hatching into tiny caterpillars which feed upon the plants. The time spent in this stage varies under different conditions, but it is probable that a month would be about the average. When full grown, the caterpillar (Fig. 2) is about an inch and a half long, with a velvety black band along its back from head to tail. At each side of this band is a narrow yellowish stripe, then a brown one, and lastly — nearly down the side to the legs — another yellowish stripe. These colors vary greatly, however, the most distinctive marking being the velvety black band on the back with the lighter band at each side.

FIG. 2. — Caterpillar of army worm. (From Report of United States Department of Agriculture, 1879.)

When through feeding, the caterpillars go into the ground, pupate and transform into moths, as already described for the earlier brood. The moths soon appear (they appeared the last of August and early in September in 1914) and lay their eggs, and the caterpillars from these feed for a time before winter, resuming their feeding in the spring. The moths this year were very noticeable toward night, feeding on honey dew on pear leaves where it had been left by the Pear Psylla, which was very abundant.

From this outline, it is evident that the caterpillars feed late in the fall and early in the spring in one generation or brood, and during the summer in another. It appears to be always the latter generation which causes the devastation and which marches in armies at times, giving the insect its name.

The army worm appears to feed generally in low meadows, near swamps, and where various grasses have rank growth. Its appearance in large armies is not a usual or normal thing, but seems to be due to the exhaustion of its food or to such great abundance as to force it to spread to other places. In this spread the caterpillars all march in the same direction until new food supplies are available, where they continue feeding. The direction of the march varies in different localities. Though usually feeding only on grasses and grains, under the pressure of hunger, it may attack peas, beets, lettuce, cabbage, cauliflower, pigweed, cranberries and other plants.

Losses and Methods of Control.

The army worm may be very abundant without its presence being known, when it is feeding on low and neglected lands, around swamps and such places. When it leaves these localities, though, and marches off in search of more food, and particularly when it reaches and begins to attack some crop of value, it is quickly noticed, and its abundance usually develops the fear that the loss will be very great.

The present season has illustrated this condition. Reports of enormous losses have been numerous from many places, but personal visits to some of these have failed to indicate any very great amount of destruction. Examination of many places where the loss was estimated at as much as $500 leads to the opinion that one-fifth of this amount would be more nearly correct.

A member of the State Board who visited various parts of the towns of Bridgewater, Middleborough, Wareham, Carver, Plympton and Plymouth during the height of the invasion this year has supplied the following statement: —

At the Bridgewater State Farm the army worms were very numerous, though Mr. Bacon, the farmer there, stated that the attack was not as bad as in 1896. The greatest injury was to oats and grass, and

Caterpillars of army worm feeding on corn. (From Slingerland.)

would perhaps reach $500. There were several smaller outbreaks in Bridgewater, but with slight money loss. Middleborough had numerous though small outbreaks, the total loss being estimated at $300. In Wareham some lawns and small fields of grass were injured, the estimated loss being less than $100. Reports of damage to cranberry bogs in Carver failed to be supported on investigation; a few mowing fields attacked indicated a loss of perhaps $100. In Plymouth no places were found where the insect was causing any appreciable injury. In these towns the whole question of damage has been much over-estimated without question, for all cases reported were followed up and always found to be much exaggerated.

When the army worm is discovered in abundance, in its usual low-ground or swampy haunts, it may be controlled by spraying there with Paris green or arsenate of lead. If the former material be used, as much as 3 pounds of the Paris green to 75 gallons of water should be used; if arsenate of lead be taken, at least 5 pounds to 50 gallons of water should be used. In either case the object of this is to destroy the caterpillars before they start to march to other fields, and after a treatment as strong as this the grass, or whatever the plants may be, cannot be used. Paris green at the strength named will probably burn the plants later. This treatment, then, sacrifices the grass, or whatever the caterpillars may be feeding upon, for the purpose of destroying the insects before they start for more valuable crops near by.

When the insects are discovered on the march, or actually at work on growing crops, the method of control must be chosen to meet the particular conditions present in each case. If they are marching to a grass field, a strip across and just ahead of the line of march can be heavily sprayed as directed above. This particular strip will of course be at least partly eaten by the army, and anything remaining would be so heavily poisoned that it would be unsafe to feed to stock. But in this way protection for the fields beyond may be obtained. Sometimes it is possible to place a thick strip of Tarvia (road oil) across the line of march. This should be kept fresh and renewed when necessary; sometimes a furrow plowed across, throwing the earth toward the army, is quite effective, the caterpillars finding it difficult to crawl up the vertical side of the furrow, and crawling along it instead. About every 10 feet along the furrow a small hole should be dug in which the caterpillars collect, and where they can be destroyed by crushing or pouring in kerosene or quicklime. A band an inch or more deep of powdered lime (agricultural lime) has proved quite an effective barrier in some cases this year, and in others better results were obtained by plowing the furrow so as to throw the earth out on the side away from the caterpillars. In any case a furrow to be effective must be thoroughly dry. The dust band so frequently recommended did not prove satisfactory.

Excellent results attended the use of a bran mash bait. This was prepared by taking 1 pound of Paris green, 25 pounds of bran or middlings, 2 quarts of cheap molasses, and water to make a thick mash when thoroughly stirred. This was placed in strips across the line of march or spread broadcast, and the caterpillars fed freely upon it. The drawback to this method is that fowls and many birds feed freely upon this mash and are also poisoned. This may also happen if birds feed upon poisoned caterpillars.

Sometimes the army worms crawl up on the stems of grasses, grains, etc., and remain there feeding, so that materials placed on the ground, such as bran mash, do not reach them. In several instances two men with a rope stretched between them, walking across fields where this was the case, would knock off the caterpillars, which would then feed upon the poisoned bait below.

If cranberry bogs are menaced from the sides, filling the ditches quite full of water should prove effective when this is possible. If not, and the worms can enter the bog or are already in it, spraying with arsenate of lead as already directed is probably the best treatment.

Enemies.

There are many enemies of the army worm. Birds feed freely upon it, and during the present season the State Ornithologist, Mr. E. H. Forbush, has collected reports that the "birds seen to feed on the army worms here and in other places were: the chipping sparrow, English field sparrow, song sparrow, robin, flicker, bluebird, blackbird, king bird. We also found the brown thrasher and the towhee apparently feeding on the caterpillars, and people reported the cow bird, cat bird, pheasant, yellow-legs and Upland Plover feeding upon them. Robins appear to be among the most effective of all, and the English sparrows were quite numerous in the browned fields, and were seen time after time feeding on the caterpillar.

The nearly extinct heath hen has increased under protection so that there are hundreds of them now on Marthas Vineyard. They receive food in the infested fields in some numbers, and apparently were feeding on the army worm, but we could not get near enough to be positive of this even with our glasses."

In addition, poultry and toads appear to consider this insect an excellent food, and devour many of the caterpillars.

Numerous insects are also enemies of this pest. Among them are several kinds of Tachina flies, which are sometimes so numerous in the fields when the army worms are abundant as to attract notice by their buzzing. They lay their eggs on the caterpillars, usually just behind the head, where they show as small whitish oval bodies. The maggots which hatch from these eggs burrow into the caterpillars and feed upon them and finally kill them, though not until much if not all of the feeding they will do has been completed. These flies and their eggs have been noticed in a great many cases this season. In addition, several hymenopterous parasites are known and several kinds of beetles feed upon the caterpillars.

Outbreaks in Future.

Various theories as to the causes determining outbreaks of the army worm have been offered, but none are wholly satisfactory. Those places where outbreaks have occurred this season are not liable to have another for a number of years. This seems to be a general rule. Even the generation which would normally appear this fall and feed till time to hibernate is likely to have been reduced by the parasites and other enemies during the summer generation so as to be of no importance or even difficult to find.

What may happen in places where the army worm was not abundant the present year is of much importance. Nothing certain can be said upon this point. It should be noted that 1896 was an army worm year over a large part of the country, and that is also true the present season, reports of the abundance of this insect having been received from as far west as Wisconsin.

In 1894 army worms were very numerous in the Cape Cod region and in parts of Franklin County near the Connecticut River in Massachusetts. No reports of its abundance in the State in 1895 have been noted. May we expect a general outbreak in other portions of the State next summer, or two years from now, thus paralleling the conditions in 1894 and 1896? It is not possible to answer this question now, but it would be well to watch the low meadows and areas near swampy land next June and July for any unusual abundance of caterpillars in the grass lands and rank growth, and if the caterpillars are plenty, kill them by spraying, as already directed, before they consume their food there and start to march to other places.

If 1915 and 1916 go by without any unusual abundance of this insect, it is perhaps probable that any immediate danger of an outbreak is over, and that a period of some years at least is liable to elapse before its reappearance.

Literature.

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CIRCULAR No. 23.

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Rural Credit, Banking and Agricultural Co-operation in Europe.

By J. Lewis Ellsworth.

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

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RURAL CREDIT, BANKING AND AGRICULTURAL CO-OPERATION IN EUROPE.

J. LEWIS ELLSWORTH.

The commission to which I was a delegate was a national commission directed to study the systems of rural credit and agricultural co-operation existing in Europe.

It consisted of 78 members; 7 were appointed by the President, 65 were appointed by the Governors of different States and by a few interested organizations, and 6 represented Canada. The delegation from Massachusetts consisted of Pres. Kenyon L. Butterfield of the Agricultural College, appointed by President Wilson, and Mrs. Charlotte B. Ware and myself, appointed by Governor Foss. The Southern Commercial Congress initiated this movement for an organized study of the systems of co-operation and rural credit in European countries, recognizing the need of such facilities in this country if our agriculture is to prosper. European countries were long since forced to face these problems and have made great strides in this direction. To them, then, the American commission turned to ascertain how their methods and organizations could be made to assist in developing a more profitable agriculture and better country life conditions here in the United States. We here in America are apt to think of the inhabitants of the European countries as rather decadent, both physically and mentally. This we found to be far from the fact, as everywhere the Italians, Germans or Danes, as the case might be, were splendid men, strong and intelligent, making a very evident success of agriculture and utilizing every bit of land that could be made available. Not only were they profiting by their systems of co-operation and rural credit, but they seemed to have a thorough knowledge of the general principles and the details of growing their crops and breeding their horses, cattle, sheep and hogs.

While in every country and at every stop, the commission gathered much of interest and much valuable information, the time at my disposal forbids even a hurried discussion of conditions in all of these different countries. I shall, then, simply endeavor to explain the two systems of rural credit which seem most successful and most applicable to our conditions, — the systems now operative in Germany, — and then give you an insight into the methods and results of business co-operation among the farmers of Germany, Denmark and Holland, with a brief reference to conditions in Austria-Hungary and France, in which five countries, and especially in the first three, both the systems of co-operative credit and co-operative business seemed to have been more fully developed than elsewhere.

Rural Credit.

The rural credit systems of Germany have to do with two distinct and necessary forms of credit, — the short-term or personal loan, and the long-term, which is usually the land-mortgage loan. In regard to the personal or short-term loan we found two distinct systems in Germany, — one serving the urban districts, the other operative in rural territory. These are the Schultze-Delitsche system, which usually operates in cities and towns and is not strictly a local institution, and the Raiffeisen system, which confines its activities to local rural districts. Our interest centers in the latter type, and I shall therefore not attempt to describe the former, but shall confine my observations to the Raiffeisen loan associations.

Raiffeisen Loan Associations.

Their founder, Friedrich Wilhelm Raiffeisen, was born of very poor parents in 1818. Although his education was very meager he developed a deep interest in his fellow countrymen which prompted him to make an effort to relieve them from oppression by usurers and "loan sharks," and evolve a scheme whereby they might secure funds at a reasonable rate of interest. The result of his efforts was the establishment of the so-called "Raiffeisen banks," which have since proved such a blessing to the lower classes in Germany. Before his death these banks had become very numerous. The memory of "Father Raiffeisen," as he is known among the German people, is one of their choicest possessions.

Briefly, the principles upon which the Raiffeisen banks are founded are as follows: —

(*a*) Unlimited liability of all members as security.

(*b*) Permanent reserve fund as additional security.

(*c*) Limitation of area, insuring personal acquaintance of all members, and none may belong to more than one society at one time.

(*d*) Loans are made only for productive or provident purposes and only to members; investigation made first as to the purpose and then as to the actual use of the loan; maximum time of loan five years.

(*e*) Facilities for repayment by installments; borrower also at liberty to cancel full debt by payment at any time.

(*f*) Absence of profit seeking, dividends being limited to rate of interest paid by borrower, if any are declared.

(*g*) Office holders, with single exception of secretary or "accountant," not remunerated for services.

(*h*) The aim is to improve not only the material but the moral condition of their members.

The capital is originally raised upon shares which are sold to members, the average cost of these shares being in the vicinity of $25. Regardless of the number of shares held each member has but one vote. No loans are made to others than members, and as a rule they are not made for more than four years, never for more than five. They are payable, not in a lump sum at a certain specified date, which often comes so hard on the borrower, but may be paid in installments. In every case the length of the term for the repayment of loans is fixed in advance, and this term and the amount of installments are proportioned to the object of the loan and the ability of the borrower to repay. These banks receive deposits both from members and outsiders, although confining all loans to members. The interest on loans ranges from $4\frac{1}{4}$ to 5 per cent. Satisfactorily indorsed notes or collaterals are accepted as security. All officers and trustees are chosen by the members and serve for four years. The "accountant," or cashier, receives about $\frac{1}{10}$ of 1 per cent on all transactions. The societies reserve the right of recalling loans upon one to three months' notice, but this is very seldom done.

These Raiffeisen banks have succeeded in reducing the rates of interest for farmers from 6, 7 and 8 per cent down to 4 and 5 per cent. Again, funds are always available, while previous to the organization of these banks there was often great difficulty in securing loans under any conditions whatsoever. These societies are not permitted to speculate in any way. They are built upon a foundation of Christianity and loyalty, but at their meetings discussions of both denominational or political subjects are forbidden.

The founder of these local Raiffeisen societies, realizing from the beginning the need of combination in order to provide centers for equalization of funds by a non-profit seeking organization, finally solved this problem by the establishment of central banks in each province. The local banks adjust the finances of their members, and the central banks adjust the finances of the local societies in the same manner. The German Agricultural Central Loan Bank in turn balances the supply and demand among the provincial central banks, obtains credit and makes necessary investments for them.

This central bank has twelve branches in different parts of the country. While the local societies are in no way under government supervision, the central bank is subject to inspection by a representative of the government, as the State has made an appropriation in its aid upon which 3 per cent interest is paid to the State. Neither the inspector nor the government can close the bank, but in case of mismanagement the appropriation can be withdrawn. The original intention was to have other co-operative undertakings carried on by the local Raiffeisen societies, but experience has proved that this is impracticable, and has shown the advisability of independent organizations for these operations. These we will consider later.

The Landschaften, or Land-mortgage Loan Associations.

Of the various land-mortgage, or long-term, credit systems operative in Germany we shall discuss but one, known as the Landschaften and found largely in northern Germany, for it seems to me that it is this system, or some modification of it, which will eventually be found applicable to conditions in this country. It is a system which will appeal to any one who has ever had experience with a mortgage on the farm, for it eliminates entirely some disagreeable features which characterize the negotiation of farm mortgages here.

To begin with, we at times have great difficulty in securing a purchaser for a farm mortgage unless the interest rate is high. This is due to several reasons: Such mortgages are not a liquid investment; the purchaser must ascertain the soundness of the title; he must determine the sufficiency of the security offered; he must see that interest and principal are collected; and he must see that the property involved does not deteriorate to such an extent that the security is endangered; and he must also see that taxes are paid. Then, too, the requirement of repayment in a lump sum, and the limited time for which mortgages are allowed to run, are very serious hindrances. These two factors in many instances force the mortgagor to either secure a renewal at a still higher rate of interest or else to contract a new mortgage. It is just these features which the mortgage-credit associations have been organized to eliminate, and this they have done, the so-called "Landschaften" especially.

To begin with, the farmer seeking a mortgage has no direct personal relations with the person who furnishes the money. He goes to the Landschaft and makes known his wants. The first step taken is to secure an impartial valuation of his property. This is made by three different parties: first, by two or three of the members of the Landschaft who live in his vicinity; second, by an independent valuer, such as the professor of agriculture in the nearest university; and third. by the officials of the Landschaft. The lowest of the three valuations is then taken as a basis for the loan, which, as a further precaution, is limited to only two-thirds of the lowest valuation. The borrower does not receive this amount in actual cash, but is given bonds to the specified amount of which he himself then disposes. He may sell them through his own banker, or the banking department connected with the Landschaft will sell them for him in the open market. The one who buys these bonds, and is really the mortgagee, has as security not only this individual mortgage but the pool of all mortgages in the hands of the Landschaft, and, in addition, the reserve fund which the organization is constantly building up. The law provides that the money of widows and orphans may be invested only in government bonds or in Landschaften bonds, the security and stability of which is thus recognized, and is due largely to the fact that the government has supervision over the organizations, each of which represents one political district.

Borrower and lender, then, do not come into any direct personal contact. The lender secures the interest on his investment, not from the borrower, but from the Landschaft. This is payable on the 1st of April and is usually 3½ per cent. If at any time he desires to make other use of his principal he cannot "foreclose," neither can he collect from the Landschaft. He simply sells his bonds in the open market.

Now as to the borrower. The day before the Landschaft has to pay the interest on its bonds it collects the interest from its members who are carrying mortgages. The rate of interest collected is 4 per cent; the ½ per cent difference between this and what the lender receives is used to meet running expenses first, and then to build up a surplus or reserve fund.

Each year the borrower pays also a fixed sum which goes toward the reduction of the principal, until at the end, usually, of either forty-five or fifty-four years the mortgage is amortized or "cancelled." The payments in excess of the running expenses and what goes into the reserve fund are used to buy up the bonds, so that when the mortgage becomes amortized the entire bond issue upon it has been bought up. If, however, the borrower fails to pay the interest, his land may be sold in the open market, and owing to the low valuation which has been placed upon it, a larger amount than the bond issue must invariably be realized. The Landschaft is reimbursed for the bonds issued and the balance goes back to the borrower. In this way the organization and the bondholders are protected, and then, too, there is also the surplus to fall back upon.

All officers and directors of Landschaften are appointed by the King, and the books and accounts are inspected and audited every month by law officers. There is, in addition, a special deputy appointed by the King to control the conduct of the Landschaft. Every possible precaution against mismanagement is thus taken, and here lies the secret of their success. It seems to me that this system, or some variation of it, combining availability of funds, low and at stable rates of interest, freedom from danger of foreclosure and gradual amortization, could be and should be worked out and put into practice as a solution to the problem of long-term credit here in America. The system itself is sound, and its success in this country would depend very largely upon the reliability and capacity of its officers.

Business Co-operation.

The subject of co-operative rural credits is very closely allied to that of business co-operation among farmers, as it requires credit to finance the co-operative societies. We have already made some progress in co-operative buying and selling in this country. The citrus fruit growers of the west, the apple producers of Oregon and Washington, and the dairymen of the northwest are among our foremost examples, not to mention the cranberry growers of Cape Cod. The fullest development, however, has as yet been reached only in foreign countries.

The co-operative societies in Germany comprise supply societies, dairying associations, corn-selling and granary associations, cattle-selling societies, egg-selling societies, electricity societies, machine societies and several minor kinds.

The supply societies deal mainly in fertilizers and feeding stuffs. One, two or three parishes are usually included in the jurisdiction of a single society, the area being governed by its ability to furnish enough members to secure the advantages of purchasing in bulk. Central organizations, representing all local societies in a province or State, are organized to make the buying power still greater and thus reduce costs still further.

There are three principal types of co-operative dairies, — those in which the cream is separated and butter made, but the milk and buttermilk are returned to the producers; those which sell new milk or utilize the new milk for making butter and cheese and use the by-products as food for pigs; and those known as cream depots, which only separate the cream, which is then sent to a central dairy or to the towns. A milk supply from at least 300 to 400 cows must be guaranteed before definite steps toward organizing a society are taken. Members must deliver to the central station all milk not needed for use on the farm or in the home. Payment is usually based on the fat content. Central organizations have been formed to some extent.

The co-operative grain-selling societies aim to secure for the producer improved facilities for drying, cleaning and grading seeds; to regulate prices by reservation of supply; to enable the farmers to secure credit with corn in the warehouse as security; to lessen or eliminate payments to middlemen; and to reduce transportation charges.

The cattle-selling associations aim at the elimination of superfluous charges in getting cattle to the market; but although attempts have been made in Germany to establish co-operative slaughterhouses similar to those in Denmark they have as yet been unsuccessful. The majority of the societies sell on commission, and all animals are insured against damage in transit and against partial or total loss at the hands of the inspectors. Many societies maintain their own system of insurance.

The co-operative egg-selling societies, in addition to the grading and handling of eggs, seek to promote the poultry industry by advising their members as to breeding and feeding, turning their attention to better methods of housing, and selling them desirable birds at very low prices.

During recent years there has been a very rapid growth of co-operative societies for providing their members with electric light and power. There are at present about 700 of these societies. A scarcity of farm labor and the introduction of different kinds of electrical farm machinery have been factors in a rapid increase in the number of these societies during the past few years. The low cost of maintenance of such machines; the absence of expense when they are not in use; the ease and quickness of their operation; the possibility of one man's operating several machines at the same time; their freedom from fire risk, and their cleanliness, all favor the use of electricity as a farm power. Its use has also been found to be relatively very economical. These societies are of three types, — those producing and distributing power, those owning their installation but securing their electricity from other sources, and those composed of groups of consumers who guarantee the purchase of certain amounts of power and thus obtain reduced rates.

Other societies in operation are vine-growers' societies, beet-sugar factories, breeding societies and land purchase and settlement societies.

An industry in Germany which assumes at least a partially co-operative form is the distilling of denatured alcohol. The distilleries are scattered through the country, about 4,000 in all, with a central selling depot in Berlin. The industry is based upon the utilization of the potato crop, nearly 80 per cent of all German alcohol being produced from this tuber, whereby the crop is made a paying one. By concentrating 900 bushels into the original weight of 100 bushels, and in this transformation using only the starch and returning the balance of the product to the farm to be fed to stock and returned again to the land, an exceedingly profitable industry was created.

All of the regulation German co-operative societies are composed of at least seven persons banded together for the furtherance of common business ends. These must take shares and make themselves jointly and severally liable, either to a fixed amount per share or to the full extent of their property. The larger number of societies have organized central banks or trading stations for provinces or States, and have further strengthened their status by creating central banks or stations operating over Prussia or Germany.

Business Co-operation in Austria-Hungary.

In Austria-Hungary the co-operative movement began little over sixty years ago, but became important with the founding of the Budapest Central Co-operative Creamery, upon the incentive of the Minister of Agriculture, in 1883. The 1912 report shows a membership of 140 farmers holding 648 shares. When organized the value of shares was 800 kronen, or $160 each. The association owns a large plant which we visited. The milk comes in from the surrounding country in large cans, and is weighed and turned into the large pasteurizing tank. Then follows the bottling for market. Sweet milk, baby milk and "sour milk" are sold. Some of the milk is separated, part of the cream being sold and butter made from the remainder. All milk is delivered to retail shops, most of which deal in milk or milk products exclusively, selling from pushcarts as well as directly from the store. Seven hundred men and women are employed to handle the output of this association, which amounted, in the month of April, 1913, to 1,909,600 liters (2,055,360 quarts) of milk. The farmers are paid according to the fat content of the milk, which ranged from 3.24 to 3.8 per cent, averaging about 3.6 per cent.

I have described the city co-operative milk plant. The Minister of Agriculture has the following to say in regard to the co-operative village dairy associations: —

Endeavors to form Village Dairy Co-operative associations were, for a long time, unsuccessful, as our people were not inclined to take up with strange movements, nor did they think it worth while to combine for the sale of their output. It was very difficult to convince small farmers that it would pay to establish an association which needed some thousands of crowns initial capital. The Minister, however, finally succeeded in persuading the inhabitants of Maria-Kemend County to form an association. Hardly half of the farmers entered, but as the business became established, every owner of a business, every owner of a cow, to the last man, eventually joined. The output of milk beyond domestic requirements, to the extent of 1,300 to 1,400 liters daily, was delivered to the association.

Butter and curds (cheese) are made by machinery, and the milk itself brings in a clear 12 heller (2½ cents) per liter. In this manner the members cleared 3,500 kronen ($700) during the year for milk, which previously was either consumed in the house or wasted. This opened a new source of income, produced greater benefit year by year, and quickly became a potent factor in the enrichment of the village farmers.

In co-operative distribution Hungary is far advanced. There are two distinct types of societies formed known as the "organized," that is, under the jurisdiction of some central organization, and the "unorganized." The central society which controls the former supplies them with goods and working capital, and attends to the wholesale purchase of supplies. They deal mainly in household necessities, provisions, seed, commercial fertilizers, machines, tools, etc. The unorganized societies are independent individual institutions and may be divided into two classes, — those dealing in household requisites and provisions and those dealing in all kinds of agricultural supplies.

I had the pleasure of visiting the central supply house of the former type of organization in Budapest. The main building is filled with all kinds of merchandise, practically everything imaginable to eat, drink or wear, also farming machinery and implements, seed, fertilizers, etc.

The establishment included mills for grinding grain, salt, sugar and paint, apparatus for roasting coffee, and a box and cordage factory. An immense force of help is employed. In 1898 there were only 16 affiliated societies, while now the organization has so demonstrated its value that there are 1,195.

In Austria we found co-operative milk plants similar to those in Budapest and other parts of Hungary. Vienna, the capital, claims the largest co-operative dairy plant in existence. The milk is distributed to the sale depots in 102 wagons, which also transport the milk to the central plant as it arrives at the railway stations from the farms. The employees at the plant number 660, and 212 horses are kept.

Including the persons who deliver the milk the number of employees would be about 1,200. The branch depots have about 210 pushcarts for delivering the milk. This immense proposition began its career in 1881 with 33 members, which in 1911–12 had increased to 631. The milk at the railroad station is valued at 4½ cents per quart. Upon its arrival at the plant it is strained and pasteurized. A specialty is made of baby milk, prepared by special methods. Fresh milk is sold in sealed glass bottles, of which from 80,000 to 90,000 are filled every night. This is said to be the largest bottling plant in the world.

Business Co-operation in Denmark.

Of all the countries visited Denmark showed the most marked development of the different types of business co-operation. The Danes were leaders in the organization of co-operative business. Formerly a corn-producing country, with Germany as its principal market, Denmark in 1879 suddenly found that market cut off by an edict issued by the German Kaiser barring admission to this product. The Danes then turned their attention to cattle raising and later to pig raising and poultry growing. Then came the necessity of disposing of their new products, first the butter, then the bacon and later the eggs. Co-operation seemed the open door, and they were not long in taking advantage of it. The piecemeal adoption of co-operation, first for one purpose and then for another, resulted in a division of the different projects, into dairy societies, supply purchasing societies, bacon curing societies, etc., so that one man may belong to nine or ten different societies, each performing a separate function.

The co-operative dairy societies compel their members to feed only certain things, to cool their milk to a specified temperature immediately and hold it at that temperature, and to obey such similar regulations as will insure a uniform high-grade product. Each member, however, is glad to be obliged by the society to do these things, which result in larger sales, a sure market and better prices. These societies have meant great progress for the small dairy farmer. The following partial description of the "Dairy Sanderum," at Odense, taken from a circular given us upon our visit to that dairy, gives an idea of this type of co-operative organization: —

Began to work on the 1st of May, 1910. Was established by the farmers of seven villages in the neighborhood of Odense, with 130 members and a total of 1,000 cows. Milk delivered in a year by its members is 2,750,000 kilograms (quarts). Besides, the dairy buys 1,000,000 kilograms from 50 farms, with 370 cows. The funds were raised by a loan for which all members are liable jointly and separately. This loan is to be amortized in a series of years. The transport of the milk from the producers to the dairy is carried on by the dairy itself, and takes place once a day at least. From the milk deliveries 30 per cent is returned to the providers and 15 per cent is used to make cheese of. The rest is sold in town as butter, cream, baby milk, sweet milk and skimmed milk. Accounts for the milk are settled every week, according to the butter quotation and the contents of fat found by testing every day. Ten per cent is retained to be paid out at the end of the year as overplus.

The dairy owns 23 wagons for transporting milk from the farmers and to its shops and customers. It also owns 12 horses for use in town delivery, but hires horses for bringing in the milk. The dairy has 20 stores in Odense selling only its products.

In this same town of Odense we visited a co-operative slaughterhouse representing about 7,000 farmers. The establishment itself is valued at 2,000,000 kroner ($536,000). The weekly killings amount to 2,200 hogs and 500 cattle, while the production per week averages 1,000 strips of bacon, 10 tons of lard, 10 tons of sausage and 10 tons of tinned goods. This is only one of many such organizations in Denmark, and is a sample of the co-operative societies which have resulted from the loss of the German market for corn and the consequent necessity of catering to the English trade. This trade demanded a different type of hog from the long legged Danish breed, and white Yorkshire boars were secured and crossed with the Danish breed, a cross which produced an ideal type for the market, weighing about 180 pounds and giving a uniform, standard product. Private concerns with large capital were at first heavy competitors, but their uneven output failed to successfully compete with the uniform product of the co-operative organizations.

Egg production forms a very important part of the Danish farmer's source of income. To increase the returns in this branch of agriculture, co-operative egg export societies have been formed. The most important of these is called the "Dansk-Andels Aegeksport." This was organized in 1895, and a fifth of all the eggs now exported from Denmark now pass through its hands. It embraces 550 affiliated branches with a total membership of 40,000 poultry keepers. Each branch has its local depot and appoints a collector who is paid a small commission on eggs collected. The eggs are purchased by weight, which induces the farmer to keep improved breeds and strains. There are stringent rules to insure that all eggs collected have been laid since the previous collection, and a penalty of a fine or expulsion is inflicted for violations. All eggs are branded with the trade-mark of the society and also the reference number of the branch society and the registered number of the member who supplied them. In this way it is possible to trace any defective egg from the breakfast table right back to the producer; and it is needless to say that very few poor eggs are found. The local depots forward the eggs to central packing stations situated in towns having convenient communication with English ports. The eggs are sorted into five different grades and packed in wool, 1,440 eggs in each box. There is the least possible delay between producer and consumer. This method insures the consumer a reliable article at a reasonable price; it guarantees the producer a maximum price as well, by the elimination of middlemen. The price paid the farmer is set by the society. At the end of each year the net profits are divided among the members in proportion to the value of the eggs received from each.

These are only some of the many forms of business co-operation in Denmark. Mention only can be made of the live-stock societies, one of which is the cow-testing association in aid of which the government appropriated 120,000 kroner (about $32,000); horse-breeding associations, pigrearing societies, sheep-breeding societies, and societies for the insurance of live stock against loss from fire, storm and hail.

Business Co-operation in Holland.

The sturdy Holland folk are indeed models of cleanliness. The stories we read of cow stables so clean that one could eat his meals in them are not exaggerated. The country is truly one large "spotless town." Marvellous progress has been made in co-operation in Holland, the government having propagated its principles with excellent results. Four forms of constitution have been drawn up, and prospective associations must adopt one of these as a basis of future operations.

Rural credit associations of the Raiffeisen type have made a remarkable growth. Co-operative purchasing societies for fertilizers and feeds are federated, but each branch does its own buying. Co-operative selling societies have mostly been organized for vegetables and fruit, and make use of the English market very largely. The dairy co-operative societies have been most highly perfected. These are federated into an "All-Netherlands Federation." The government early saw the advantage of State control of testing, and now does it all, placing at the service of the farmers skilled testers, who act also in the capacity of general advisers. The product which stands the test is branded with the sign of quality, "Nederlandsch Botercontrole," which is recognized as a guarantee in all markets. A form of society originally established in Switzerland and later in Denmark and Holland for recording milk yields, especially those obtained by breeding for production, has shown excellent results. In 1897 the average yield was 812 gallons; in 1904, 1,019 gallons. Since that time it has declined, but it still stands at 898 gallons of 3.5 per cent butter fat.

Holland has about 400 co-operative horse insurance societies, insuring about 40,000 animals, and 50 to 60 goat and sheep insurance societies, covering some 6,000 animals.

French Co-operation.

While the commission was in Paris, M. Albert Viger, who has several times been Minister of Agriculture, gave an address. He stated that there are 10,000 co-operative associations in France with a membership of 65,000. These societies purchase feeds, fertilizers, seeds and agricultural tools, and sell dairy and other products of the farmers.

Co-operative societies conduct mutual insurance against loss by fire, crop damage by hail, cattle loss from disease, and life insurance. These insurance societies are for farmers only and have a membership of 80,000. Individually these societies would be weak, but they are federated into one large and powerful association. This central organization maintains a legal department where any question of law is looked up, legal papers drawn or examined and legal advice given to members. As many as 10,000 letters are received and answered every year. The organization of this work was a difficult matter and required a deal of hard labor by M. Viger and his coworkers, for strong opposition, especially from insurance companies, was encountered. Their sign is two hands clasped and their motto, "One for all and all for one."

Much more might be said and written in regard to the wonderful trip of the commission and its opportunity for observing conditions and methods in the several countries visited. I feel, however, that I have said enough to at least set you thinking, and I trust that I have made clear some of the methods and practices which have proved so successful across the water. I feel that co-operation is the keynote of future progress and universal success in agriculture in this country. We shall do well to get out from under the framework of individualism upon which we have so long depended for shelter from competitive products, and upon the solid foundation of agriculture erect a framework of co-operation which will, beyond a question, be sufficient to sustain any burden of competition which it may be called upon to support.

I would suggest that the milk producers in the several different sections of the New England States build co-operative creameries convenient to the largest supply, expending only the amount of money really necessary to build and equip such plants, so that the farmers can stand ready to demand a living price for their milk; and if the buyers do not agree to the proposed price, the milk can be converted into butter and the skimmed milk returned to the farmers under the same method that is pursued in Denmark.

The interest on the money invested to carry out this scheme would be very small, and should be considered as belonging in the same class of expenditures as insurance.

Mr. George McKerrow of Wisconsin informs me that an organization of farmers in Woodstock, Illinois, has carried out this plan successfully, and increased the price received by the producer for milk 10 cents per 100 pounds.

One other suggestion to help solve the milk question on the lines above recommended is that the Boston Chamber of Commerce, through its committee on agriculture, help finance a co-operative milk-selling plant in Boston. With such a plant in operation the producers would receive more for their product, while the price to consumers would not be increased. Indeed, I firmly believe that under co-operative methods the price to the consumer would be lowered. So let us strive for co-operative organization here in Massachusetts, to the end that our farming may be made more prosperous and our life upon the farm may be still more worth the living.

Mr. Taylor. I would like to ask Mr. Ellsworth what prices they get for milk in Germany.

Mr. Ellsworth. The farmer gets from 2¼ to 2½ cents a quart, and in some parts he gets as high as 4 cents.

Mr. Myrick. I would like to make one point very briefly and very vigorously to the farmers of Massachusetts, and that is that the basis of co-operative success in Europe or in this country is going to be financial co-operation, banking co-operation, credit co-operation. Now, we have had in Massachusetts since 1909 a credit union law. It is one of the best laws; it embraces the best results of European experience in co-operative credit societies. We should have these co-operative credit societies formed under that law in every school district and township in Massachusetts. Though the law is here, it has not been agitated; it has not been considered by the farmers' organizations, and yet, it is a most excellent law. It was enacted in the State of Texas last year, and it came very near being enacted over in New York. That law should be supplemented by carrying out the Landschaft idea in the form of a land-mortgage bank, under the auspices and with the co-operation of the State, and a bill, or a standard measure, for that purpose has been drawn, and I have copies of it here for any one who is interested. This bill for a State land-mortgage bank should go through the Legislature of this State this next year, and Massachusetts should lead the way not only in the local co-operative banking under the law of 1909, but also in the land-mortgage bank.

Just one word further: of course, the price of money varies with supply and demand, but under a proper system of land-mortgage banking the current rate of interest, whether high or low, now paid, or ordinarily paid for mortgage money, will be sufficient not only to pay the interest, but also to pay the expenses and gradually pay off the principal.

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ALFALFA GROWING.

By Joseph Wing.

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ALFALFA GROWING IN MASSACHUSETTS.

JOSEPH E. WING OF MECHANICSBURG, O.

Coming the other day by day train through New York and then through western Massachusetts, I gazed out of the car windows with deep interest. I longed to know well the old land of my fathers. The little farms fascinated me. I longed to know whether it is well with them, whether or no there is prosperity there, and hope and good outlook. And as I came along, I mentally rebuilt many of the farms that I saw. I drained the marshy places. I took out the dividing fences and made the fields larger. I limed the fields, and covered some of them with alfalfa.

It was deeply borne in upon me that there is need for an alfalfa crusade in this old land, for from Rochester to Springfield I did not see one field that I was sure was set to alfalfa. Nor did I see one field that could not grow it, when conditions are made right. There is no crop that has greater possibilities for the New England farmer. It is a hardy plant. Frosts do not much damage it. You may not be well situated for corn growing, but you are well situated for growing alfalfa. You are not too far north, for they are growing it by thousands of acres in the Saskatchewan, where the thermometer goes often to 50° below zero. They have learned that alfalfa does not winterkill there when they leave uncut the last growth. That is a lesson that Massachusetts farmers need to learn, perhaps, — to leave a strong growth to hold the snows of winter and to protect the crowns of the plant. On Woodland Farm, our home in Ohio, we let the alfalfa go into winter always with a growth of a foot or more, and since we learned to do that we have had no winter-killing.

Doubtless you have before heard the praises of alfalfa sung and now you ask, "Is it a practicable crop for the Massachusetts farmer? Can I grow it? I live on the sandy river bottoms; can I grow it there? I live on the clay hills; can I grow it there also?"

To this I reply, "Yes, alfalfa will grow profitably on every farm in Massachusetts. There are no exceptions, so long as the drainage can be made good. Let us consider the requirements of the alfalfa plant. It makes its growth mainly by the aid of the bacteria that inhabit its roots. These bacteria live upon the air that is in the soil. They have the power to take nitrogen from the air, digest it, and make available the nitrogen for feeding the plants. The lesson is plain. Alfalfa must not be in a waterlogged soil. There must be air in the soil as well as moisture. Drainage, then, is the first requisite of an alfalfa field.

Lime is the second requisite. All the natural alfalfa-growing regions of the world have soils strongly impregnated with limestone. Idaho alfalfa fields have about 4 per cent of limestone in them. Colorado soils have at least as much.

Nebraska soils have from 1½ to 4 per cent of carbonate of lime. In Onondaga County, N. Y., where alfalfa grows so easily and so well, the soil is rich in lime; the rocks underlying the region are of limestone. Successful alfalfa growing is a mere matter of the chemistry of the soil, — that and the attention to a few easily learned likings of the plant.

When it comes to liming soils for alfalfa growing, one needs to forget most of what he has read of the functions of lime in the soil, because alfalfa uses lime in a different manner and for a different purpose from most other plants. The lime is for the bacteria, to enable them to gather the nitrogen from the air. Just how this is done we do not know, but this is sure: with abundant lime in the soil we find abundant and active nitrifying alfalfa bacteria, while without the lime we find few bacteria and these inactive. Markedly healthy alfalfa is always found to be on soils filled with limestone. To the alfalfa plant limestone in the soil is far more important and essential than manure.

Given drainage, a soil filled with air, then limestone, what comes next in the order of essentials to alfalfa culture? Next I put manure turned down deep under the soil. Once an alfalfa field is established, I never afterward put stable manure on it, but keep it going with chemicals instead; but I like well to turn under a good coat of manure when I establish a field. The manure does much more than feed the plant, it promotes bacterial life in the soil as well. Where a soil has much manure and much limestone as well, one will find his biggest, healthiest alfalfa; and if he will dig down in the soil he will find immense numbers of nodules containing the nitrifying bacteria. As alfalfa needs to be established only once in five or more years, one can afford to give it a lot of manure when he lays it down.

Next in order of importance I put phosphorus and potash. Alfalfa draws heavily on the soil for these mineral elements. I like to use basic slag for this purpose. Five hundred pounds to the acre seems with me to do as well at the outset as more, but as it is a fairly cheap substance, and does not leach away from the soil, one can just as well apply 1,000 pounds to the acre, and it will be all the better for it. For the potash, one can use either muriate or sulphate, whichever is the cheaper, and at rates of from 200 pounds per acre up, depending upon the soil. Soils derived from granite rocks, and good heavy clays, ought not to need much potash. Sandy soils and peaty soils will need more. It is an element that does not leach away; once applied, it is yours until the plants get it, that is, except on very sandy soils. On these, no doubt, frequent small applications will prove better than occasional large ones.

Inoculation comes next in order. I like to take soil from a good alfalfa field and sow it directly in front of a harrow at the rate of about 400 pounds to the acre, or more if it is readily available. That gives efficient inoculation, or one can use the commercial cultures on the seed. I think that these cultures are now generally successful. They cost more than does the method of soil inoculation; that is their only fault I think. Or one can use both soil and seed inoculation, and that is the best way of all. The better the inoculation the more rapid will be the growth of the young alfalfa; the sooner it will get above the weeds. Inoculation is never needed twice on the same land, for when alfalfa has once grown on it successfully it will remain inoculated for a very long time, if not forever.

Making the Seed Bed.

I like to plow deep for alfalfa, but to plow some time before seeding if I can; then work the land down firm and make the surface level. We use the plank drag for this. With the seed bed level one can cover the seed accurately and not too deep. Half an inch is the proper depth of seeding; an inch may do no harm, but deeper than that will usually kill the seed.

We like to sow with an alfalfa drill, for then we can better regulate the rate of seeding and also the depth. The drill makes the seed go further also. Ten pounds of alfalfa seed drilled in to a proper depth in a good seed bed will give a very thick stand, and fifteen pounds sown broadcast will give enough. If the seed bed is poor, however, you must use more seed.

The time of sowing does not much matter, though I prefer to sow early in order to get a strong plant before winter comes. As soon as hard freezing is over in the spring one can sow, say, by April 15. If frosts come after the alfalfa has come up, all the better; they will kill some of the weeds and will not be likely to kill the alfalfa. Alfalfa may also be sown in May or June, July or even early in August. It will do well sown at any season, but better I think in New England if sown in early April or late July.

As to the nurse or cover crop, there are two kinds that are permissible and, I think, only two; and only in early spring should any nurse crop be sown. Beardless spring barley is the best, sown at the rate of 1 bushel to the acre, no more. It will make a good cutting of hay and the hay is of good quality. Oats shade the alfalfa too heavily and are an injury to it. In midsummer sow no nurse crop at all. The alfalfa then needs all the soil and all the moisture for its own uses.

The other permissible nurse crop is winter wheat, sown at the rate of a bushel to the acre at the same time that the alfalfa is sown in April. The effect is to discourage weeds and grass. The wheat cuts a small crop of hay of good quality and dies at midsummer, leaving the land clean for the alfalfa.

Each year on Woodland Farm we sow alfalfa in all three ways: alone, with barley and with wheat. We are not able to say which is the best, as all give us good stands; but the barley gives us the profit of a crop of hay, and then nearly as good a stand of alfalfa as when it is sown with wheat or alone. I advise the Massachusetts farmer to test the thing on his own land by sowing strips in each way and observing the result.

Having the alfalfa sown, and covered lightly by drawing a plank drag over it, or by some other method that will not cover it too deep, we may be certain that it will grow vigorously. The next thing is to know when to cut it. Not knowing this has cost many alfalfa growers dear. Barley or wheat is to be cut for hay, but we do not pay attention to these plants in deciding when to cut the alfalfa; instead we observe the little alfalfa plants with care to see when they start, down by the surface of the ground, little new shoots or buds. When these shoots start we cut the alfalfa, together with its nurse crop. We never cut sooner. That is the rule for cutting alfalfa during all its life, to cut it when the little shoots have appeared and not to cut it earlier; for it is ruin to alfalfa to cut it before these shoots appear. Why this is, no one knows, but take my word for it, it brings ruin; and perhaps more alfalfa fields in Massachusetts have been made unprofitable in this manner than in any other. Do not pay attention to bloom, or lack of bloom, as an index of when to cut, but be governed by the state of the basal shoots or buds entirely, and this throughout all the life of the plant.

Now, that is all, except one important thing: keep out of the alfalfa field except when you go in to make hay. Especially in winter do not allow any one to trespass in it. Let it alone. And remember when you are harvesting your 5 tons of hay per acre that alfalfa draws heavily on the soil for phosphorus and potash, and feed the alfalfa meadow every year. Our standard top-dressing in Ohio is of acid phosphate or basic slag 500 pounds, and of muriate of potash 100 pounds per acre. Thus fed it keeps in strong growth for five to ten years at least. When June grass runs into the alfalfa, take a spring-tooth harrow and dig it out. Go over the land in two directions and tear out the last root of the grass. Bucher & Gibbs, Canton, O., make a special alfalfa spring-tooth harrow that will take out any sort of grass and leave the alfalfa unharmed. This is best done just after taking off a crop of hay, immediately after the hay is raked. The harrowing will not harm the alfalfa; will do it good, in fact.

Now let's go back to the lime question, seeing that it is the key to alfalfa growing in Massachusetts. I like to use the unburned ground limestone. It is the cheapest and best source of lime for the soil, if one is so situated that he can get it. Happily, a beginning has been made in limestone grinding in your State. There cannot be a farm in Massachusetts that does not need a full carload of limestone. Buy it in bulk and get it in car lots at the low price, then use it liberally. I prefer to use as much as 8 tons to the acre of raw ground limestone or marble dust. Of course there are cases where this would be too costly, and less must be used at the start. Then additional lime can be applied later and worked in with the spring-tooth harrow. Of burned lime I would use from 2 tons up to the acre. There are localities where burned lime is the cheaper source of calcium. Ground limestone has, however, the better effect on alfalfa.

As to the probable profits. Any acre of land in Massachusetts that is tillable and drained can profitably be set to alfalfa. The cost for lime, fertilizers, manure, seed and labor may be as much as $50, or even more. The cost of lime and manure are the determining factors. The first year one gets two cuttings, supposing he sows in April. The first cutting is of barley hay, say 1½ tons to the acre. Later he gets a cutting of pure alfalfa hay, of about 1 ton to the acre. Next year he gets three cuttings, one of about 2 tons, one of 1½ tons, one of 1 ton, or from 4 to 4½ tons per acre.

There is no expense of seeding or preparing the land after the first year. One merely feeds back the chemicals that the alfalfa has withdrawn from the land and harvests with joy and great profit his crop. It is the surest crop there is except the pasture grass and the forest trees. There is no need whatever of failure in establishing alfalfa in Massachusetts. In recent years I have helped establish alfalfa on farms from Texas to Vermont, without a single failure. Why, just below New York, in northern New Jersey, at Plainsboro, is the Walker-Gordon farm with 475 acres of alfalfa, all recently established and all successful. From that farm they sell nearly $1,000 worth of milk each day, and it comes in large part from their own soil, through the channels of the alfalfa roots. That farm is not on especially favorable soil. Mr. Jeffers, the manager, is simply an alfalfa enthusiast, and manures, drains, limes, inoculates and sows the alfalfa with never a fear of failure. He buys an old, "worn out" farm and pulls out the old fence rows, cleans it up, manures and limes it, and sets the whole farm at once to alfalfa.

Gentlemen, last spring I came home to Woodland Farm from a long journey and found on the farm 100 acres of alfalfa that seemed to me especially beautiful and fine. I longed for men to come and see it, and so we announced that we would give a picnic on Woodland Farm, an Alfalfa Day picnic. The Governor came, Dean Price of our Agricultural College came, many other notable men came; and to our bewildered joy there came also 3,500 men and women from our own State of Ohio and adjoining States.

It was one of the happiest days of my life. We tramped through the fields together and then assembled on the lawn, where lectures were given and information imparted how successfully to grow alfalfa. In a little booklet we have put pictures of this great gathering of farmers, and given quite careful instructions how to grow alfalfa. If you will send us your names we will be glad to send the booklet.

Question. I had a soil which is a light loam, with sand underneath, and I put on 2 tons of burnt lime on one-eighth of an acre, ten years ago; and at that place the alfalfa has done better than anywhere else.

Mr. Wing. That makes about 16 tons to the acre, and simply illustrates the fact that alfalfa is a plant that is crazy for lime.

Mr. Wilder. What about witch grass?

Mr. Wing. That is a terrible thing, especially in New England, isn't it? We find that two years of very thorough cultivation of corn will entirely eradicate it, but we cultivated that corn a little more and deeper than we ought to have for the good of the corn. We used two horses and cultivated with a sharp, narrow shovel that goes down deep and takes out the grass, and absolutely destroyed it in two years. We do not sow the alfalfa in land until the witch grass has been thoroughly cleaned out.

Mr. Olmstead. I find that if you wait until the alfalfa blossoms, you will get a pretty hard first cutting for good feeding.

Mr. Wing. Well, sometimes alfalfa will get a little bit harder the first cutting than you like, but even if it should, you must not cut before the shoots come. Now, I will tell you a little story. Down in Georgia I started some alfalfa for a gentleman. It got finer and finer. I got some ground limestone and put it on that poor, red clay soil, and made it grow marvelously, so that he got from some of the acres 5 tons to the acre, and it was a wonderful sight. Then he got a man down from the north, a mighty intelligent man, who came down to manage the alfalfa farm. This man knew cows wonderfully well, but he did not know alfalfa at all. The first time he cut the alfalfa he cut it two weeks too late. Naturally, it was very woody and the cows didn't like it. Then, he said, "I will remedy that," and he cut the new cutting ten days too soon. The cows liked that, but the alfalfa didn't like it, however; and after he had cut it once more ten days too soon, I never saw such a wreck as that field was. The next growth was yellow and red, and the weeds were over the top of it, and the alfalfa looked as though it was going to die; and he had 150 acres in that condition.

Prof. H. J. Wheeler. I wish you would say what you would do if a very severe attack of leaf blight struck your alfalfa, — whether you would cut it or leave it.

Mr. WING. Dr. Wheeler, I would never cut it, even with leaf blight, until the shoots appeared. By the way, the leaf blight, in my experience, comes very little if a man has his soil chemically right and if he hasn't been trespassing on it in some way. I found some places where the fishermen had made a path through the alfalfa, as they went down to fish, and the leaf blight followed along where they went; and where the teams turn around in the alfalfa, where the corn fields join onto it, it also appears; but in the 100 acres we have in alfalfa at Woodland Farm we have no blight except in spots like these. But even if I did have it, I would not cut the alfalfa until the little shoots come. I might feel awfully sorry, but I wouldn't cut.

Professor WHEELER. In the case of long protracted drought, with, say, three weeks of no rain, it becomes woody and the leaves drop.

Mr. WING. I believe even then, even with the long drought and the leaves dropping off, I would wait for the little shoots. I would be afraid to cut before they appear.

Mr. PALMERTON. Why do you recommend muriate of potash instead of sulphate?

Mr. WING. Because it is cheaper with us, that's all. I should think one would do almost as well as the other, would it not, Professor Wheeler?

Professor WHEELER. I think the muriate has the advantage of being the more soluble, and if you put in enough lime you will be ahead of the game by using the muriate instead of the sulphate.

Secretary WHEELER. I would like to ask what kind of seed you use.

Mr. WING. That is very important in New England. In New England I would not use the imported seed, because you are likely to get the Turkestan, which is not very productive under your conditions; and may even get something worse, such as that from Algeria, which will not stand the winter here; and you might get various kinds of weeds. I would rather get the seed for here from Montana, the Dakotas or

Nebraska, for that will be hardy, or else the Grim, which is a Minnesota strain which has been grown a long time.

Professor WHEELER. Won't you speak about curing and the danger of spontaneous combustion?

Mr. WING. Oh, yes. Well, the little leaves have in them nearly all of the fat and the protein, actually more than is in wheat bran or middlings. Now, what would you think of having one of your hired men go out and cover an acre with middlings or wheat bran? You would say, "Heavens! What a waste," and yet there are men who do what amounts to the same thing with their alfalfa. The lesson is to rake it before the leaves drop off, while they are still tough enough to hang on. You can't tell when that will be, but I was going to say I would begin mowing in the afternoon and make the hay the next afternoon, but I am not sure about that. I would let it lie there long enough, then rake it in small windrows. Our rakers have these instructions, to make the windrows small, and then make the shocks not wide and spread all over the ground, but narrow and tall; and when they are put up in that way the stems have a drooping tendency and a big rain can fall and hardly damage it, and it may stay in the shocks a day or two. But you must not leave it there very long, because the young alfalfa is going to come right up and will be bleached under the shock. So, if the next day is good and hot, about 10 or 11 o'clock come out and open it about four or five forkfuls, and then it may be turned over and be dry enough to be ready for the barn.

Dr. Wheeler spoke about spontaneous combustion. A great many barns are burned from putting in alfalfa hay that wasn't dry enough. Get it as dry as you can, — not bone dry, but it should never be wet enough for moisture to be wrung out of it; that is our test. That should be the very outside limit; and get it as much dryer than that as you can. I have seen it go into a barn holding 120 tons, and come out without much damage. It has come out yellow or brown, but never had damage from mold. However, in a barn where you only put a few loads you must get it dry or you will have some mold.

That is all I know about curing, except the various ways of putting it up on frames. It is a good plan, of course, to have covers to put over it. I have had a hay cap made of sheeting about 42 inches square. Mr. Jeffreys, in his big alfalfa farm in New Jersey, has them, and he has a wire like a woman's hat pin that he sticks in each corner to hold it on the shock.

Mr. PALMERTON. I would like to ask something further about lime; you spoke of using ground limestone as preferable, perhaps, to burned lime. Did I understand you correctly?

Mr. WING. I think it makes bigger alfalfa.

Mr. PALMERTON. Now, in New England here we are offered a ground marble which is as insoluble as sharks' teeth.

Mr. WING. Ground marble dust?

Mr. PALMERTON. Well, I should say granulated marble, and I want to know whether that is preferable to hydrated lime or burned lime, — so-called air-slacked lime, — or whether a good carbonate of lime, shell marl or something of that sort would be all right.

Mr. WING. It is all a question of price. Will you please tell me what the marble dust is costing you?

Mr. PALMERTON. Down here in this section, about $4 or $5 a ton.

Mr. WING. That is too much. I believe there is a place somewhere in western Massachusetts where they grind it and put it on the car for $1.50 or $1.25 a ton. They put it on the car for $1.25 in carloads, and if there is one farm in New England that couldn't use a carload of limestone, I don't know where it is. You ought to buy it in carload lots. That price of $5 a ton for ground marble dust is entirely too high. I would rather use burned lime than the marble dust at that price. But I don't know that it makes a great difference what form you use, if you remember that the unburned only has about half as much calcium as the burned. Marl has good results if it has enough calcium.

Mr. F. H. RAY. I bought lime last year for $4.75, and dry marl for $6. We pay $3.50 for lime at the quarry, and pay $1.75 to get it out. We can buy marl for $6 a ton, and burned limestone I think costs us $7.

Mr. Wing. Burned limestone would be cheaper than the marl at that rate. Now, I think you need a cheaper source; you need lots of places that are grinding it. Oyster shell ground makes a good source.

Mr. Ray. I think it costs about $5 a ton delivered, in carload lots.

Mr. Wing. We have worked up a cheaper source of supply in the west, for some reason, than you have here. We do something that is rather a joke on the lime grinders. We buy screenings from the limestone quarries that they mean to sell to the concrete workers. We buy it for 75 cents a yard, and a yard is 2,800 pounds, and by putting it on in larger quantities we get fine results. Some of you might be so situated that you could get it.

Mr. Ray. We can buy ground lime ash for about $7 a ton.

Mr. Wing. Some lime and some potash in that. However, that is pretty expensive, too.

Mr. W. L. Mitchell. I believe that many of you are not aware of the compulsory by-product of the lime from our kilns and the lime burners, which I accidentally ran across some years ago, and which is usually sold and delivered under $7. In fact, we have a good quality of lime ash, of which the supply is limited, but it costs not over $3, usually a little less than that, carrying a little wood ash, with from 50 to 75 cents or $1 per ton of plant food value, often, and from 45 to 50 cents worth of lime.

Mr. Wing. Very good.

Mr. Mitchell. Then we have a lot of stacked lime, a by-product of the kiln, stacked sometimes higher than this room, which is partly recarbonated and still takes a long time to airslack through the stack, getting a little combined moisture, which doesn't seem to show much more than the hydrated, but costs about the same. That supply is going to be open. If you can get it on the basis of freight at $1.50, for $4.50 per ton in bulk, with that plant food in it, it seems to me something important that has been overlooked. In New York State they have tried to get it and have offered more money, but I have felt an interest in New England, and New England has had her share so far.

Mr. PALMERTON. Might I ask for the best people to deal with?

Mr. MITCHELL. There are several kilns near Pittsfield not owned by the lime trust.

Mr. PALMERTON. The rate from there to here is something like $2.25 a ton.

Mr. MITCHELL. It is 5⅓ cents, and going east, only $1.50 a ton, clear into Boston for $1.40 a ton, on the Boston & Albany road. The other roads have not given us suitable lime rates, the Boston & Maine in particular.

Mr. WING. The railroad people, a great many of them, are interested in agriculture and they have the farmers in mind, and it seems to me that if they are properly interviewed they might learn to give you the right sort of lime rate. In Illinois and several other western States the roads haul it for ½ cent a ton a mile, and that is the rate you ought to have here.

Secretary WHEELER. I would like to ask what is the relative advantage between inoculating with some of the bacterial preparations or cultures and with soil. Do you not think that using soil, taking it from one farm or one center to another and sowing it, is likely to introduce very dangerous weeds which wouldn't be introduced by using the culture?

Mr. WING. There is something in that. Cultures cost $2 an acre, and that is my first objection. I believe they are now fairly efficient, and if you have used the amount of manure that you really ought to have, you will get inoculation with the culture, I am sure. However, we have never been particularly afraid of weeds in alfalfa. I believe you have more permanent ones in Massachusetts than we have.

Mr. MAYO. This is an introduced weed (indicating a plant).

Mr. WING. There may be something in that which might frighten me more than I have been frightened.

Professor Brooks. The plant which has been held up by the speaker, which somewhat resembles the wild strawberry, is what we call cinquefoil, or, in English, five fingers. There are several species of that, and this one is the most common. The gentleman who brought it here in talking with me said that he thought it had killed the alfalfa. I told him that while he might be right, I thought it was probable it was more a symptom than a cause; that it indicated an acid condition of the soil, and that was the reason the alfalfa died. Now, while I am on my feet — and I will say I hope there is a representative of the New York, New Haven & Hartford Railroad present — I might say that while it is fashionable to say a great deal against the New Haven road in these days, I happen to know that its management has taken up this matter of furnishing the farmers cheaper lime. I believe, indeed, that I brought the matter to their attention among the first. They are establishing a plant in western Connecticut for grinding limestone, and they propose to sell it at the lowest possible rate, and will give reduced freight rates to any points reached by their lines. I am not able to say just what the rates will be, but I know that that is their plan.

Mr. Wing. That is splendid.

Mr. Mayo. I would like to know if you think it is possible by hybridization to get an alfalfa plant which is more drought resistant, a more vigorous grower and one that would have more growth of foliage.

Mr. Wing. Well, Professor Hanson is working on the hybridization of alfalfa, and we will wait for him and see what comes out of it.

Mr. F. E. Peck. I would like to ask how you get the lime deep enough. Do you plow it in?

Mr. Wing. We like to apply half of it before plowing and the other half afterward. Then the half that is put in before plowing is turned under, and the next half is mixed with the disc harrow.

Mr. Peck. Do you apply it again after the crop is established?

Mr. Wing. Yes, we have done that, too, with fine results.

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HOW TO BUY FERTILIZERS.

By R. Edwards Annin, Jr.

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

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HOW TO BUY FERTILIZERS.

R. EDWARDS ANNIN, JR.

All plants require ten elements for their growth. These are carbon, hydrogen, oxygen, nitrogen, iron, sulphur, calcium, magnesium, phosphorus and potassium. The first four are gases, and three of them — carbon, hydrogen and oxygen — are secured by the plant from the air and water without the necessity of any aid from man. Of the six elements which come from the soil, iron, sulphur and magnesium are usually present in sufficient quantities and available forms in practically all soils. Continuous cropping, however, has brought most soils in Massachusetts to the point where nitrogen, phosphorus and potassium are not present in large enough *available* quantities to produce maximum crops. They may be called the essential fertilizing elements. Calcium (lime) is rarely needed as a fertilizing element, but is often needed as a soil amendment; that is, to sweeten sour soils and make heavy soils more friable. It may, therefore, be called an occasional fertilizing element.

In buying commercial fertilizers, therefore, farmers are buying nitrogen, phosphorus and potassium in highly concentrated form. A few things that commercial fertilizers can and cannot do should be kept clearly in mind.

1. Some of them, such as dried blood and cottonseed meal, do add some organic matter (humus) to the soil, but only a small part of what is needed.

2. They will not correct poor drainage conditions.

3. They will not overcome bad results due to poor seed, improper planting or careless methods.

4. They may have a slight good or bad effect on the physical condition of the soil, according to how they are compounded.

5. The best brands of commercial fertilizers are quickly available to plants, and so the food contained in them is mostly used the year of its application. The potash and phosphoric acid which they contain will be available to future crops if more is applied than is used the first season. From an economic standpoint fully enough should be used each season to produce the crop sought.

Barnyard manure and commercial fertilizers are often compared, to the disadvantage of the latter. This comparison would be more intelligent if it was kept in mind that barnyard manure not only adds the three fertilizing elements to the soil, but is also the most useful of soil amendments in that it (1) adds large quantities of humus, (2) contains innumerable beneficial bacteria, and (3) opens up clay soils and makes leachy soils more compact and retentive of moisture and plant food.

A large part of the plant food contained in solid manure is very slowly available, and so the effect of a heavy application may still be seen for some years. This means a long delay in securing returns on the full investment.

In comparing fertilizer and manure it should also be noted that many farmers expect 200 or 300 pounds of a cheap ready-mixed fertilizer, costing, perhaps, $1.50 a hundred, to show as good results as 20 two-horse loads of manure, worth at least $1 a load.

The question of buying fertilizers, therefore, resolves itself into securing at the least cost the most pounds of the three elements, and in getting them in the best proportions and combinations to supply the plant as required. It is important to avoid using a large excess at any one time, and to have the fertilizer compounded so as to prevent its loss by leaching. To do this intelligently the following facts must be known: (1) the amounts and availability of the three fertilizing ingredients contained in the various goods offered for sale, (2) the value of these ingredients, and (3) the character of the soil and of the crop to be grown.

The fertilizer laws now on the statute books in most States require that all fertilizers be sold on a guaranteed analysis, and that this analysis shall be printed on the bag or container. The only figures that need be printed to comply with this law in some States are the percentage of total nitrogen, available phosphoric acid, insoluble phosphoric acid, and of total potash, but Rhode Island requires soluble phosphoric acid. The fertilizer bag sometimes has printed on it, or on the tags attached, a number of figures which might at first seem to be unnecessary, such as the equivalent of nitrogen in ammonia; but in some States this is required by law, so in order to meet all State requirements both are often given. The equivalent of potash in sulphate of potash is necessary to show the fact, in case it is not all from muriate. These figures may be misleading to some persons not thoroughly acquainted with fertilizer lore, and it would be a step in the direction of intelligent understanding of these matters if the fertilizer laws could all be made uniform as concerns these requirements.

The figures on the bag are on a percentage basis. For example, a fertilizer with 2 per cent nitrogen, 5 per cent phosphoric acid and 6 per cent potash would contain in 1 ton, 40 pounds of nitrogen, 100 pounds of phosphoric acid and 120 pounds of potash.

While it is unnecessary for a farmer to carry in his head the exact analyses of the fertilizing materials, as these are published annually in the fertilizer bulletin of the Massachusetts Agricultural Experiment Station, it is desirable that he should have a working knowledge of the make-up of the principal raw materials, which are as follows: —

Nitrate of soda contains about 15.5 per cent nitrogen.

Sulphate of ammonia contains about 20.5 per cent nitrogen.

Acid phosphate contains about 12–16 per cent available phosphoric acid.

Basic slag contains about 12–18 per cent total phosphoric acid.

Muriate of potash contains about 50 per cent potash.

High-grade sulphate of potash contains 48–49 per cent potash.

In order to find the money value of fertilizers another essential factor must be brought into use, namely, the value per pound of the several fertilizing ingredients.

This information is published annually by the directors of the experiment stations of the eastern States, and is reproduced here in abbreviated form: —

	Cents per Pound.
Nitrogen in nitrates,	16.5
Nitrogen in ammonia salts,	16.5
Organic nitrogen,	22.5
Phosphoric acid, soluble in water,	4.5
Phosphoric acid, insoluble,	2.0
Potash in sulphate of potash,	5.0
Potash in muriate of potash,	4.0

With these two sets of figures of the analysis and trade values at hand it will be simple to compute the trade value of any fertilizer. An example will make this clear. Take the mixed fertilizer mentioned previously in this article, a 2–5–6 brand, and let it be assumed that four-fifths of the phosphoric acid is soluble in water, and one-fifth insoluble, and that all the potash is in the form of muriate of potash. It must be recognized that two fertilizers having the same trade value may still vary in their crop-producing power, dependent upon the materials used in compounding them. The value of this brand would be computed as follows: —

1 per cent nitrogen (organic) equals 20 pounds per ton, at 22.5 cents equals	$4.50
1 per cent nitrogen (nitrate) equals 20 pounds per ton, at 16.5 cents equals	3.30
4 per cent phosphoric acid equals 80 pounds per ton, at 4.5 cents equals	3.60
1 per cent phosphoric acid equals 20 pounds per ton, at 2 cents equals	.40
6 per cent potash equals 120 pounds per ton, at 4 cents equals	4.80
	$16.60

This particular material should cost $16.60 per ton at retail in the large market centers, such as New York or Boston; and to this, of course, must be added the cost of new bags and freight to the buyer's station.

Nitrate of soda analyzing 15.65 per cent nitrogen would contain 15.65 x 20 = 313 pounds of nitrogen, and should be worth $51.64 per ton.

If this simple method of figuring fertilizer values were universally used farmers would often find that they were paying too much for their fertilizing ingredients when bought in some of the mixed goods having a low analysis. These "cheap" brands are the most expensive to buy. A ton of 2–8–2 fertilizer costs just as much to mix, ship, handle and to bag as a 4–8–10, but its value will be barely half as much. It must be evident that freight is being paid in the former case on a large amount of unnecessary material on account of the lower analysis of some of the ingredients used in their manufacture. High-grade ready-mixed goods, on the contrary, are often as economical for the farmer as unmixed chemicals.

Finally, in buying fertilizers, buying the raw materials and mixing them at home will sometimes be found to be economical. A shovel, a sand screen and a tight floor are the only essentials; provided, of course, that certain of the chemicals are reground just before using them. Care must be taken, however, not to mix the materials until just as they are needed, as otherwise many of them are sure to become hard and difficult to handle.

The bags in which original shipments of nitrate of soda, sulphate of ammonia, and potash salts are made are particularly likely to be torn because of the hardening of the contents. In such cases more or less material is wasted. Some of it is also absorbed and held in the bags in which it is shipped. These losses, and the necessity of cash payment for chemicals, must be considered in comparison with the good drillable condition of ready-mixed goods even after long storage, the shipment in sound new bags, the extension of reasonable credit, and the fact that the ammonia is less subject to loss by leaching than when wholly from nitrate of soda, as it frequently is in home-mixed goods.

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NUT CULTURE.

By William C. Deming.

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NUT CULTURE FOR MASSACHUSETTS.

WILLIAM C. DEMING, SECRETARY OF THE NORTHERN NUT GROWERS' ASSOCIATION, GEORGETOWN, CONN.

It is within the range of sane belief that, had the nut tree been as easy of propagation as the apple or peach, the hills of New England would now hold as many orchards of nut trees as of the other fruits. The best specimens of our native nuts would have been selected, grafted and sold by nurserymen. Foreign nuts would have been introduced, and acclimated varieties of the Persian and other walnuts, almonds and filberts developed.

At first thought it seems strange that this has not already been done, but a little reflection will disclose the reasons. To hundreds of men has occurred the idea of growing nuts. The natural thing would be to plant the nuts themselves, choosing fine types and planting the best. The results were always disappointing. Filberts grew well but died off about the time they were beginning to bear. Almonds either died from the effects of climate, or did not bear, or what they bore was of little value. The shagbark, butternut and black walnut grew slowly because never given cultivation or fertilization, rarely bore before they were fifteen years old, often not until they were twenty-five. Some bore little or nothing, and of those that did bear freely the nuts were almost always inferior to the planted nuts. The same remarks apply to the pecan, except that in the north few trees, raised as they almost all were from Texas or Louisiana nuts, could stand the climate, and those that did either bore no nuts, or those they bore did not fill or were too small to be of any value. The "English" walnut has been often planted, and while a few trees have survived and are the source of our great expectations for this nut, most of them did not live or, if they did, either did not bear at all or bore an inferior nut after long years of waiting.

The chestnut alone has been developed to a large degree, due chiefly to the comparative ease of propagation, and was our only nut certainty, until the blight came and put a halt to progress in this direction.

Of course it occurred to some to try to bud or graft from choice native trees on native seedlings. But this was almost invariably a failure, as great refinement of technique is necessary for success in propagating most of the nut trees. The chestnut, almond and filbert are easier of propagation, but these have all been interfered with by the causes mentioned.

For these and for other reasons it has been slow work reaching the point which we believe we now have reached, where we can make rapid progress in nut growing, due chiefly to our acquirement of the art of budding and grafting all the nut trees.

Not all the problems are yet solved, but we think that we can see the way to solve them, though we have not yet advanced so far that we can advise commercial planting. We are still in the experimental stage, and except for a number of chestnut orchards, mostly in New Jersey and Pennsylvania, and an orchard of about 225 seedling walnut trees in northern New York, there are no bearing, commercial orchards of nut trees in the north.

The success of the pecan in the south, and of the almond and walnut on the Pacific coast, the growing number of persons able to live in the country, or to have country places, and the consequent increasing interest in the accompaniments of country life, together with the activities of an enlarging group of individuals and societies, farseeing enough to foretell the future great importance of nuts, — all have contributed to cause an interest in nut growing that is spreading rapidly.

With our growing population and the increasing restriction of our great cattle ranges, the consequent diminishing meat supply and increase in its cost, active minds are looking elsewhere for our supply of the important, muscle-building, energy-yielding, expensive protein element of our food.

This will be supplied chiefly from such sources as cheese, dried fish, the legumes, the hen and nuts. We shall grow nut trees, not too close together, between them beans and alfalfa, keep some chickens and a cow, and be forever independent of the butcher, even if we do have to send to the grocer for an occasional codfish for our Sunday morning fish cakes. We can predict the day when it will be possible to send to the grocer's, not the butcher's, for a nut chop or steak. Thus the distasteful associations, and possible dangers, of butcher's meat may be easily done away with if we choose.

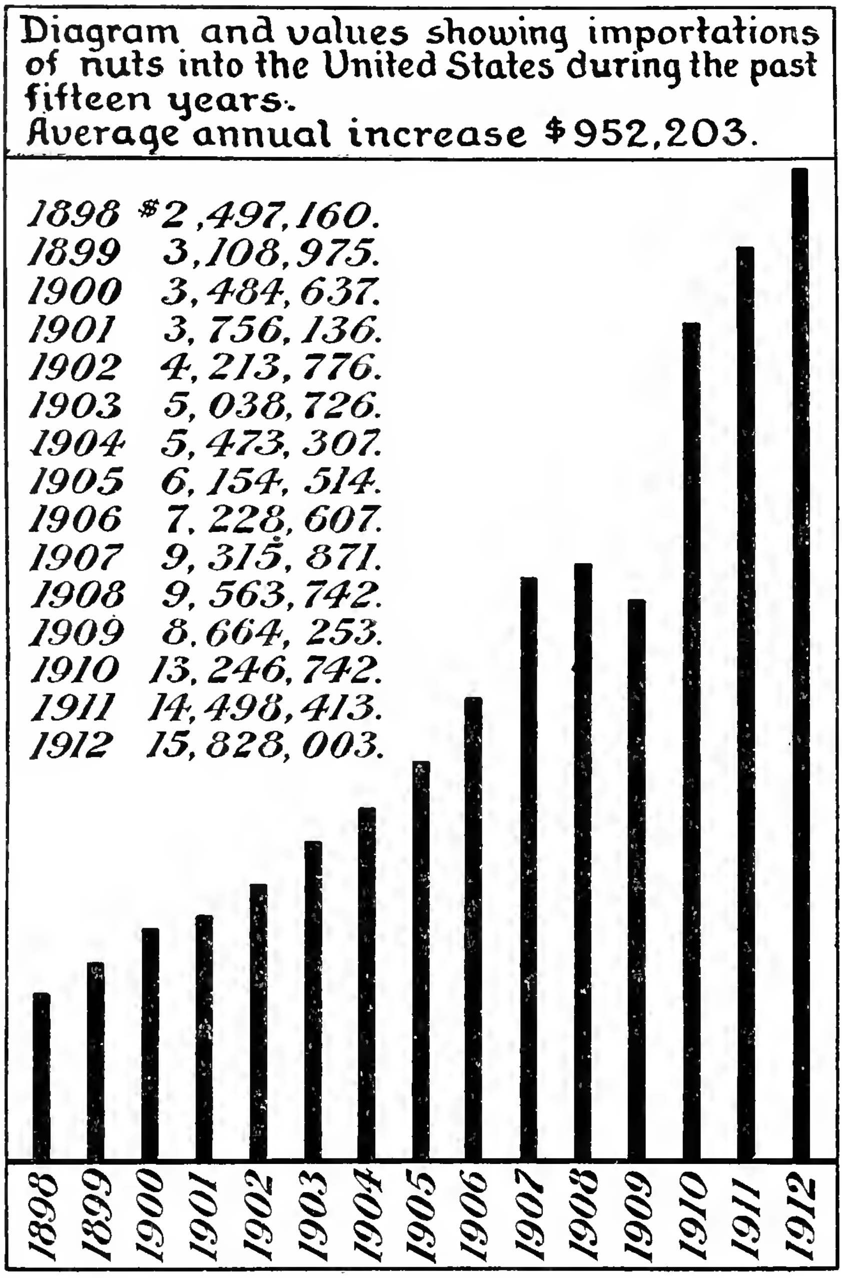
The following table shows how nuts rank, in comparison with some other articles of diet, as suppliers of protein, fat and starch.

Food Value of Nuts, and of Other Foods for Comparison.

Nuts.

	Protein.	Fat.	Sugar, Starch, etc.	Fuel Value per Pound (Calories).
Almond,	21.4	54.4	13.8	2,895
Beechnut,	21.8	49.9	18.0	2,740
Brazil nut,	17.4	65.0	5.7	3,120
Butternut,	27.9	61.2	3.4	3,370
Chestnut, dry,	10.7	7.8	70.1	1,840
Cocoanut,	6.6	56.2	13.7	2,805
Filbert,	16.5	64.0	11.7	3,100
Hickory nut,	15.4	67.4	11.4	3,345
Peanut,	29.8	43.5	14.7	2,610
Pecan,	12.1	70.7	8.5	3,300
Pine nut,	33.9	48.2	6.5	2,710
Pistachio,	22.6	54.5	15.6	3,250
Walnut,	18.2	60.7	13.7	3,075
Other Foods.				
Beef steak,	19.8	13.6	-	950
Cheese, Cheddar,	27.7	36.8	4.1	2,145
Eggs, boiled,	12.4	10.7	-	680
Wheat flour,	11.4	1.0	74.8	1,650
Beans, dried,	22.5	1.8	55.2	1,605
Potatoes,	2.2	.1	18.0	385
Apples,	.4	.5	13.0	290
Raisins,	2.6	3.3	73.6	1,605

From this table it may be seen that butternuts contain about 28 per cent of protein, or the same as Cheddar cheese, and a third more than beefsteak. Pecans contain over 70 per cent of fat, or twice as much as the cheese and more than five times that of the beefsteak and nearly seven times as much as eggs. Chestnuts contain 70 per cent of starch, or nearly as much as high-grade wheat flour and four times



Reproduced by permission from the "Pecan Review."

as much as potatoes. One can see that something more can be made of nuts than a relish or a dessert.

The importance of nuts as food is further shown by the importation of nuts and nut products into the United States, and the rapid increase in the value of the importations.

Further evidence of the importance of nut growing may be found in the extent of their cultivation and use in Europe and other continents. The walnut trees on many farms in southern France determine its rental value and form a chief source of income to the tenant. In parts of France, Italy and other countries chestnuts furnish flour for bread for man, and chestnuts and acorns furnish forage for animals. Prof. J. Russell Smith relates that when he stopped at the house of the mayor of a little town in Corsica the mayor went to a bin and brought out a measure of chestnuts to feed the horse.

In Mediterranean countries the almond is an important crop for home use and export.

In our own country the walnut, almond and filbert on the Pacific coast are becoming industries of national value. In 1912 they produced 3,000 tons of almonds and 11,250 tons of walnuts.

In the south the development of the pecan, and of the pecan industry, is one of the wonders of horticulture. Barely twelve years ago the propagation of the pecan was practically unknown, and seedling trees the sole dependence. Now thousands of acres are occupied with tens of thousands of trees, grafted or budded from selected wild trees. These wonderful pecans, that hardly any of us northerners have ever seen, so different from the grocery store pecan, and that fetch up to 50 cents or more a pound in the home markets of the south, are not artificial hybrids, the result of man's scientific work, but nature's own product which has been merely propagated and perpetuated by the art of man. The same process is awaited by the native nuts of the north. The walnut growers of the Pacific coast and the pecan growers of the south have shown us the way.

The entire success of nut growing depends on the art of propagation. To get trees bearing true to type, and as early as the apple, we must set grafted or budded trees, just as with the apple. No one should think of setting an orchard of seedling nuts any more than an orchard of seedling apples or peaches. Of course the development of new varieties must come from raising seedling trees by planting nuts.

One in many of these seedling trees will be notably superior. On this account the growing of seedlings from hybrid or selected nuts must be practiced by those who have the opportunity, but the perpetuation of superior nuts, secured in this way, or found in nature, cannot be accomplished by planting nuts, but only by a sexual propagation. Consequently, the man who wants to grow good nuts, and only good nuts, must either plant budded and grafted trees or graft and bud his own seedlings.

Success in grafting and budding the walnuts and hickories can be attained only by expert knowledge, hired or laboriously acquired. The other nuts are mostly fairly easy of propagation by the usual methods.

Government and other bulletins may be had that teach by word and diagram the methods of propagation. But an easier and surer way to learn is to practice under the eye of an expert.

Beginning with nut culture should not be delayed, however, until one has learned the art of propagation. Nuts should be planted, and budded or grafted trees, to be obtained now from special nut nurserymen, should be set, and the methods of propagation may be practiced and learned while the nuts are growing to furnish stocks and the costly trees to furnish scions.

Top working native walnuts and hickories to improved varieties is a promising, though hardly demonstrated, possibility.

It is the habit of the walnuts and hickories to send a taproot down until it reaches permanent water. A tree that, from any cause, is prevented from doing this will not attain its perfect development nor reach the allotted span of its existence. To get the most perfect development of such a tree Mr. J. C. Cooper suggests, as an illustration, that an old well be filled with rubbish and good soil and the tree planted over that.

Nurserymen's instructions for setting and after care should be carefully followed. The first two or three years are critical times with these taprooted trees, rudely torn from their half-accomplished purpose of fighting their way through the hard earth to permanent water. They must be visited almost daily at critical periods, and treated with all the refinements of horticulture that can be mastered, but above all given plenty of deeply placed water when droughts are upon them and winter protection until well established.

Soil and climate requirements are not fully known. Comments about these will be made under the individual nuts, and in the course of the general remarks.

Planting nut trees about the house and barns may be recommended, as such locations are usually fertile, bushes and weeds would not be present, daily observation would be more likely, and most nut trees are desirable for shade and ornament.

Fence corner planting is not to be recommended, since the trees generally have to compete with native and adapted weeds, bushes or trees, and they are out of sight and mind.

Roadside planting has had advocates, but is usually undesirable, as it would be for fruit trees in general, on account of the reasons given above and because of the depredations of man and his straying animals. Some day, when the whole country is a garden, and the government the gardener as in some foreign countries, such planting may be advantageous.

For the man whose nut-growing tastes are scientific the creation of new kinds of nuts by cross fertilizing offers a field unexcelled in horticulture. The walnuts cross so freely with one another, as also do the hickories, and even some hickories with walnuts, that the possibilities seem endless. Results have already been attained in breeding fine chestnuts, immune to blight, by crossing the American chinkapin and the Japanese chestnut. This work ought to be much more extensively taken up by experiment stations and private individuals.

The literature in this country on nut growing is fairly comprehensive, except that the only systematic works on the subject are not up to date. Every one interested, however, should read " The Nut Culturist," by Andrew S. Fuller, the

Orange Judd Company, New York, 1906, for its information, the charm of its style and the enthusiasm of the author.

"Nut Culture in the United States," United States Department of Agriculture, 1896, should also be read. but is out of print and scarce.

The government publishes separate bulletins on the pecan, walnut and other nuts, their food value, diseases, etc., and most of the States where the pecan and walnut are grown have issued bulletins on these nuts. Most of these, and other nut literature, are listed in a circular of the Northern Nut Growers Association, sent free on application to the secretary, and the annual reports of this association contain papers and discussions on different phases of nut growing.

Can Nuts be grown in New England?

Of course every one knows that a great quantity of nuts is already grown in New England, but every one also knows that most of them grow where nature planted them. What we want to know is whether we can grow nuts that will be greatly superior to the wild nuts, — the ordinary run, — and whether we can grow them in quantity for our own use or for commercial purposes.

The answer will come under the following two heads: —

1. *The Development of Our Native Nuts.*

The pecan in the south shows us what can be done. It is just as possible with our own native nuts. Far off in the fields and forests there is many an old nut tree that bears a nut worth growing; there must be some that are better than most of us have ever seen. Year by year these are passing away and, with our diminishing forests, they are not being replaced by nature. We now know how to propagate nut trees. It is therefore the duty of every one who cares anything about such things to make known to some authority any tree whose nuts he thinks sufficiently valuable that it may be propagated. If it is any incentive to such an act, it is safe to promise that the nut, if worthy of perpetuation, will be given the name of the person who first makes it known. There are as yet not a half dozen northern nuts, excluding the chestnut, that are being commercially propagated. Practically, there is but a single nut, the Hales hickory, and that is sold in very limited numbers.

2. *The Introduction of Alien Nuts.*

This part of the subject had best be taken up under the head of the individual varieties.

Let us consider first, and for the sake of completeness, those nuts about which there is the least to say.

The Pistachio. — This is being tried by experimenters. The following remarks about the almond will apply, in a general way, to this nut. At present we know too little about it to say more.

The Almond. — The finer varieties of this valuable nut are being grown very profitably on the Pacific slope. It appears to be well demonstrated that the so-called soft-shelled almonds are either too tender in wood to stand our climate, or they bloom so early in spring that they are caught by late frosts. It seems also to be a fact that the hard-shelled almond is quite hardy and bears fruit even in New England. It has been asserted that the fruit of the hard-shelled almond is not valuable, while others say it is as good as the soft-shelled, the only difference being in the shells. Bulletin No. 26, Bureau of Plant Industry, United States Department of Agriculture, 1902, page 7 says, "The most valuable almonds of commerce are those grown in southeastern Spain. They are hard-shelled varieties. . . ."

It would seem as though the almond ought to grow wherever the peach will, being of that family, or that it could be trained to do so. There appear to be no records of attempts to breed hardy varieties, and this apparently offers a good field for experiment. Large numbers of seedlings should be grown from seeds of choice varieties, brought from their northern limits, perhaps from Oregon or Washington in this country, or from Europe. Variation in the resulting seedlings should give us, in time, the wished-for adapted varieties.

Good authorities consider the almond worth growing for its beautiful flowers alone.

The Pine Nuts. — In many parts of the world the edible seeds of various species of pine are more or less used for food. They sometimes come on the market as *Pinolas* or *Piñon* nuts. In the Andes mountains is a pine that bears very large nuts or seeds. Many of the edible seeded pines are hardy and offer a good field for experiment.

The Beech. — Experts believe that this splendid tree is worthy of trial and experiment as a nut-producing tree. The nut is familiar to us all. If one could be found that was of some size it would be of value. In many localities the nuts do not fill. It should be grown on rocky hillsides and other places unfit for cultivation, to furnish mast for the fattening of hogs.

The Oak. — As a mast producer the oak probably ranks before the beech. There are varieties bearing nuts sweet enough to be edible by man. It seems as if a way should be found of utilizing, in this country as in foreign countries, the very abundant fruit of this great, hardy and long-lived tree. It is very suitable for reforesting rocky slopes to furnish mast for swine, and for its timber. More attention should be given to growing the beech, oak and chestnut as forage producers for feeding animals. J. Russell Smith says, "Approximately nine-tenths of the proceeds of American agriculture go to nourish the quadruped, and man eats the remaining one-tenth."

The Chestnut. — This is the great tragedy of nut growing. The chestnut is culturally the highest developed of our native nuts. A number of men have crossed our native chestnuts and various foreign ones and produced varieties of ample size and excellent quality, bearing young and abundantly. Commercial orchards have been established in a number of places, and many smaller ones for home use, and many of these were bearing profitably. The chestnut industry appeared to be on an established basis, but a few years ago the chestnut blight appeared and has upset the equilibrium of the situation. The disease is now found from Maine to the Carolinas, and even on the Pacific coast. Where it first began it has killed every tree. It seems to be gradually doing the same wherever it is present. It is true that in some of the older cultivated commercial orchards the claims of the owners, that they can keep the blight under control by constant watchfulness and inspection of the trees with control measures, seem to be borne out. But it looks as if our native trees were doomed.

A bright ray of hope for the cultivation of chestnuts has been shed by the experiments of Dr. Van Fleet of the United States Department of Agriculture. It is now accepted that the chestnut blight was imported from the Orient where it is found endemic. The Oriental chestnuts have more or less immunity. So has our native chinkapin. Dr. Van Fleet has crossed the chinkapin with the Japanese chestnut and got resulting hybrids combining the size of the Japanese and the high quality of the chinkapin, at the same time securing great, perhaps complete, immunity from the blight. Moreover, these chestnuts bear very young and annually, some bearing in less than two years from the seed, and some of them several pounds of nuts in their third year. These nuts are not yet available for distribution, but persons who are interested should consult the "Journal of Heredity" for January, 1914, where Dr. Van Fleet describes his experiments and results with illustrations. This number also contains two illustrated articles on the chestnut blight.

Recommendations for the chestnut in New England at present are to try them in very limited numbers, giving them good care to promote vigorous growth, and watching them to discover the earliest evidences of the blight, which should be treated as the pear blight would be. Unless they can be given this careful attention it would be better not to set them at all.

There are no immune varieties of the American chestnut. Among the best of those we have are the Rochester, Boone and Paragon, which may be bought of several reliable nurserymen. The Japanese varieties are generally coarse and not of good quality, though there are said to be superior ones. The Japanese chestnuts grow rapidly, bear young and are beautiful, and useful as screens or in masses.

Many cases of severe illness, and several deaths, have been attributed to eating chestnuts from blighted trees, and until official verification or refutation of such assertion is obtained it would be better to abstain from eating chestnuts from trees affected by the blight, and even from those growing in regions where the blight is present, even though the particular tree may show no evidences of it.

The Filbert. — No native hazel large enough to be worth propagating has been brought to notice. This is a pity because the native hazel is practically immune to a blight that attacks the large imported filbert and destroys it before profitable crops are born. On the Pacific coast, however, the disease seems not to be present, and the nut is successfully grown. Spraying with Bordeaux mixture might keep the blight under control, but what we must work for is a good filbert that is immune, by selection from native types or crosses with the foreign filbert. Such experiments are under way, and when the desired result is obtained a promising field of nut culture will be opened, for the filbert is very hardy, of rapid growth and early maturity, productive, easy of cultivation and adapted to many soils and climates.

It is the nut from which to get quick results, to tide over the period of waiting for other nut trees to mature. As fillers between such other trees the filbert ought also to be valuable.

Conquering the filbert blight is one of the most important problems of nut growing.

The Hickories. — Of this family of about sixteen members, all native only on the North American continent, the first in importance, at the present time, is the pecan. Its great development in the south has been spoken of, but it has also a future in the north.

It grows as a native in southern Indiana and the neighboring States, where immense trees are found in large groves of pure stand, and some of the nuts are almost the equal of the southern pecan in size, and equal, if not superior, in quality. The pecans of this locality have received the general name of "the Indiana pecan." The best of them are being commercially propagated and can be bought in quantity. How far north of its native habitat it can be moved.

and continue to fruit profitably, is unknown. Even the southern pecan tree may be perfectly hardy in the north. There is one at Hartford, Conn., that is 9 feet 3 inches in circumference, and others in New England, but none, so far as I know, that bears an edible nut. This may be sometimes because of imperfect pollination, but is due more probably to insufficient length of growing season. Statements by nurserymen as to the bearing possibilities of any pecan north of New Jersey and Long Island are purely fanciful. One cannot say what they will do, for none are known to be fruiting.

But there is every reason to believe that pecans of the Indiana type will be found to fruit successfully much farther north than their native range, and their trial is recommended.

The Shagbark Hickory. — The shagbark is the pecan of the north, waiting its turn for the development its southern brother has had.

As it appears in the market it is as variable as the grocery store pecan; some small, thick-shelled, difficult to extract from the shell, or of inferior quality; while now and then is found one that has the opposite characteristics. At its best it is nearly the equal of the pecan in quality. Some prefer it.

There is nothing now to prevent the selection of the best of our native shagbarks, their propagation, dissemination and growing in orchard form. The ordinary run of native shagbarks retails at 15 to 20 cents a pound. If there are 60 pounds in a bushel the value of a barrel of ordinary "hickory nuts" is of easy computation. Even now selected shagbarks rival the high-priced pecans.

When we have determined the best shagbarks to grow, which we have not yet done, we can send scions to expert propagators, or we may get them to come and top work our native seedlings, or any variety of hickory, to the shagbark or the pecan of our choice. Or we may learn to do this ourselves.

The tree is perfectly acclimated over most of the northeast, and will grow in many places where only forest trees can find a foothold. It needs only to be well cared for until established, and given room for development, and it will take care of itself. It is said to do best where there is lime in the soil, which, of course, may be added.

The Walnut. — We must be on the lookout for types of the black walnut and butternut that are worth growing. Both these are native and hardy, the butternut flourishing further north than the other, and if such nuts can be found they will fill a valuable place. Their propagation is sufficiently simple, as all the walnuts can be grafted or budded interchangeably.

The Japanese heartnut has striking characteristics that make it valuable for the north. It is very hardy and grows with extreme rapidity under favorable circumstances, making a very handsome tree and bearing early a heart-shaped nut of good quality that cracks easily from the shell. This nut is worthy of extended trial, but one should have a guarantee from the nurseryman that it is not the Siebold walnut, a very similar tree, but one that bears a very inferior nut.

The Persian Walnut ("English" or Circassian Walnut, Madeira Nut). — The so-called "English" walnut is attracting more popular attention as a nut for northern growing than any other at the present moment. One reason for this is that, while it is not a native nut, here and there a tree is growing and bearing well in almost every State in the Union. Some of the best of these are being propagated and can be bought in quantity, but very probably there are better ones that have never been brought to the attention of nut growers. All such trees should be made known and studied, for it is certain that the nut is going to be one of the most valuable for northern propagation, and some day a great food and revenue producer.

Recommendations.

These depend on the tastes and wishes of the man who wants to grow the nuts. If they are strictly scientific, with time and money to back them, let him experiment with the less known kinds, such as the almond, pistache and pine nuts; let him raise great quantities of seedlings, discard the unworthy majority and test out the minority; let him help in the search for valuable types of native nuts, and labor to simplify and perfect the art of propagation; let him breed chestnuts and filberts that will resist the blights; and let him experiment with the hybridizing of nuts and all its wonderful possibilities.

If he only wants a few trees for home use, and to satisfy a variegated horticultural taste, let him set one or two trees of as many different varieties as his preferences and opportunities allow, much as he would so many fruit trees, only being sure to give them extra good care, especially for the first few years.

If he wishes to grow nuts to make money, the time is not yet come when the planting of orchards on a commercial scale can be recommended. If he were willing to risk it, however, particularly if his location or climate were especially favorable, orchards of carefully selected varieties of the Persian walnut, properly managed, would be almost certain to be profitable, and orchards of the Indiana pecan would be a bright possibility.

Far outside the native range of the chestnut, in a favorable locality, to be determined only by trial, a chestnut orchard might prove very profitable. The promising new immune hybrid chestnut may entirely change the face of the chestnut-growing industry.

The advantages and desirability of nut culture might be summed up as follows: —

Advances in the art of propagation, and other factors, have now made available nut trees that will bear early and true to type, like our apples and peaches. The uncertain seedling is no longer our sole dependence.

The products of nut culture are clean and free from disease germs, unless contaminated by unsanitary handling after cracking. The careful person will have his nuts cracked and the meats picked out at home, or cooked before eaten.

They can be kept and used as needed and do not require refrigeration like meat, and the chance of ptomaine poisoning, if possible, is very remote.

They are palatable and varied in flavor and capable of being prepared as food in many different styles.

They are of high food value, as already shown, and in cost they compete on at least equal terms with other sources of food.

After the trees are once established, but not until then, no great amount of care is necessary, so far as experience goes; harvesting can be done by a child, cold storage is not needed, the product is not soon perishable and market gluts will not be likely.

The life of many nut trees, when properly grown, is very long, much longer than that of the other fruit trees, in most instances.

Even a few nut trees about the house will supply the family, help to solve the problem of the high cost of food, and provide some income. From 21 pecan trees, seven to twenty years old, on his own home lot, Mr. J. B. Wight of Cairo, Ga., in 1911 sold the nuts for $500. The Lindsay pecan tree at twenty-three years of age bore 638 pounds of nuts.

There is no more peace and satisfaction giving occupation than that of horticulture, and no more fascinating branch of horticulture than nut growing.

Series of 1913. Vol. 26. No. 2.

MASSACHUSETTS CROP REPORT

FOR THE

Month of June, 1913.

Peach Growing in Western Massachusetts.

circular 27

ISSUED MONTHLY, MAY TO OCTOBER, BY STATE BOARD OF AGRICULTURE, STATE HOUSE, BOSTON, MASS.

Wilfrid Wheeler, *Secretary*.

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CONTENTS.

Approved by
The State Board of Publication.

Crop Report for the Month of June, 1913.

Office of the State Board of Agriculture,
Boston, Mass., July 1, 1913.

Owing to the unusually large size of the May crop report, and to the moving of the State printers, that issue was unavoidably delayed in publication. It is the purpose of those in charge to have a set date upon which the report shall be issued, and upon which it may be expected by its readers. To insure such publication it will be necessary for our correspondents to make their returns as nearly as possible upon the dates specified upon the blanks. The blanks will be sent out a day or so earlier, so as to give more opportunity for observation and inquiry.

The reports on different specialties have been continued in this, the crop report for June, the list of questions has been broadened where possible, and our staff of special correspondents has been increased as fast as desirable persons could be secured. Full reports of frost injury and insect damage are contained herein, and methods and practices in different sections are outlined. The information received through the market-gardeners' returns in regard to irrigation will be found of especial interest, as the practice is receiving more and more attention each year; a larger number of returns, however, would have been productive of still more valuable data. The special bulletin this month is entitled "Peach Growing in Western Massachusetts," and was prepared by Mr. L. W. Rice of Wilbraham, and delivered by him at the last annual meeting of the Massachusetts Fruit Growers' Association. Mr. Rice is actively engaged in the peach-growing industry, and is one of the most practical men whom we have in this State. This article, then, is especially interesting and valuable to those who are now engaged or are planning to engage in this industry.

CROP CONDITIONS JUNE 1, 1913.

The Crop Reporting Board of the Bureau of Statistics, United States Department of Agriculture, estimates, from the reports of the correspondents and agents of the bureau, as follows for the United States: —

Crop.	Acreage, 1913.		Condition June 1 (Per Cent).			Condition May 1, 1913 (Per Cent).
	Per Cent of 1912.	Acres.	1913.	1912.	Ten-Year Average.	
Spring wheat,	97.0	18,663,000	93.5	95.8	93.8	-
Winter wheat,	116.4	30,938,000	83.5	74.3	80.7	91.9
All wheat,	108.3	49,601,000	87.2	83.3	86.1	-
Oats,	101.1	38,341,000	87.0	91.1	88.4	-
Barley,	96.3	7,255,000	87.1	91.1	90.5	-
Rye,	-	-	90.9	87.7	89.7	91.0
Hay,	-	-	87.5	89.8	-	88.5
Pastures,	-	-	89.2	93.7	89.5	87.1

The estimated yields indicated by the condition of crops on June 1, 1913, and final yields in preceding years, for comparison, follow: —

Crop.	Yield per Acre (Bushels).			Total Production in Millions of Bushels.			
	1913.[1]	Final Estimate, 1912.	Average, 1908-12.	1913.[1]	Final Estimate, 1912.	Final Estimate, 1911.	Census, 1909.
Winter wheat,	15.9	15.1	15.2	492	400	430	418
Spring wheat,	13.5	17.2	13.3	252	330	191	265
All wheat,	15.0	15.9	14.5	744	730	621	683
Oats,	28.8	37.4	29.7	1,104	1,418	922	1,007
Barley,	24.4	29.7	24.5	177	224	160	173
Rye,	16.5	16.8	16.2	-	36	33	30

[1] Interpreted from condition reports.

WHOLESALE AND RETAIL PRICES COMPARED.

[FROM THE CROP REPORTER OF THE UNITED STATES DEPARTMENT OF AGRICULTURE FOR THE MONTH OF JUNE.]

The marked advance in prices during the last twenty years, and consequent discussion of the cost of living, prompts many persons to make inquiries concerning the difference between consumers' and producers' prices, and concerning whether such differences have widened owing to the recent increased prices.

Most agricultural products before reaching the ultimate consumer undergo some modification or manufacture. Wheat is manufactured into flour, hogs are slaughtered and converted into pork and lard, and many fruits and vegetables are preserved or canned. Probably three-fourths of all products undergo some such modification between the primary producer and the ultimate consumer. Eggs, milk, farm butter, live poultry, and green fruits and vegetables comprise practically all products which are purchased by the ultimate consumer in the same form as sold by the producers, and there are exceptions among these products; for instance, milk is frequently modified and bottled, and country butter is now a relatively small portion of all the butter sold.

In 1910 the Department of Agriculture made an investigation of the farm, wholesale and retail prices of butter, eggs, milk and poultry. From this investigation, which was made in the last week of January, 1910, it appeared that consumers in the 71 cities covered were paying an average of about 38.1 cents per dozen for fresh eggs, retail dealers were paying about 32 cents, and near-by producers reported receiving an average of 30.4 cents; the average price received by all producers of the United States, according to reports of county correspondents of the Bureau of Statistics, was 28.9 cents per dozen. Near-by producers frequently receive a premium over the prices of distantly shipped eggs; also, many farmers sell their eggs directly to the consumer, in which cases the consumer's price and the producer's price would be the same. The average price paid by the consumers, 38.1 cents, was about 19 per cent higher than the price paid for eggs by retail dealers, 25 per cent higher than that received by near-by producers, and 32 per cent higher than the average price received by producers of the United States, 28.9 cents, as stated above. In this calculation no allowance is made for losses occasioned by breaking, spoiling or otherwise between the producer and consumer.

Chickens were purchased by consumers at 18.7 cents per pound and by retail dealers at 15 cents, while they were sold by near-by producers at 11.7 cents; the average of reports of all county correspondents at about the same time was 11.1 cents per pound. The price paid by consumers, 18.7 cents, was nearly 25 per cent higher than the price paid by retailers, nearly 60 per cent higher than the price reported received by near-by producers, and 68 per cent higher than the average price received by all producers, as reported by county correspondents of the Bureau of Statistics.

The average price paid by consumers for milk was 8.5 cents per quart; the average price paid by retail dealers was 4.7 cents, and the average price reported as received by producers was 4.5 cents. In some cities there are wholesale receivers and retail delivery dealers; the average price paid by delivery dealers to wholesale dealers was 6.4 cents. The price paid by consumers for milk was thus about 89 per cent higher than the price received by those producers who did not peddle their milk.

The average price of creamery butter in tubs to consumers was 36.5 cents per pound; the price paid for it by retail dealers was 31.8 cents; the retail price thus being nearly 15 per cent above the price paid by the retail dealer.

In order to ascertain whether the relative differences between producers' and consumers' prices have widened during the last twenty years, comparisons have been made of the relative retail prices of certain articles reported by the Bureau of Labor Statistics with the wholesale prices, together with the raw material from which manufactured, as reported by Bradstreet's. The articles selected are wheat and flour, steers and beef, hogs and ham and lard, sheep and mutton.

Comparing the average of prices for the last ten years, 1903–12, with the preceding ten years, 1893–1902, it appears that the price of wheat (No. 2 red, Chicago) advanced 32 per cent, the wholesale price of flour advanced 29 per cent, and the retail price of flour advanced only 28 per cent.

The price of hogs advanced about 33 per cent; the wholesale price of hams advanced 24 per cent, and retail price of smoked hams advanced about 32 per cent; retail smoked bacon advanced 55 per cent, and pork chops advanced 41 per cent; the wholesale price of lard advanced 31 per cent and the retail price advanced about 30 per cent. The price of steers (Chicago) advanced 24 per cent; the wholesale price of beef advanced 23 per cent; the retail price of sirloin steak advanced 19 per cent; round steak advanced 30 per cent; and rib roast advanced 23 per cent. The price of sheep advanced 19 per cent, and the wholesale price of mutton advanced 36 per cent; the retail price is not given.

The average farm price of potatoes on December 1 of the ten years, 1903–12, as estimated yearly by the Department of Agriculture, was about 26 per cent higher than for the preceding 10 years, whereas the retail price advanced in the same period about 29 per cent.

It would appear from the figures quoted that whatever be the margin between the producer's price and the consumer's price it has not widened much, if any, during the last twenty years of advancing prices.

WEATHER OF JUNE.

The weather of the month was of the average midsummer type, with temperature about the normal, and rainfall irregularly distributed, and, generally speaking, below the average for June. The daily temperatures were without marked extremes, the maxima ranging in the 80's on many days, but seldom above 90°, and the night temperatures in the 60's, excepting during the closing week, when the nights were warmer. In some sections there was a scarcity of rain, and droughty conditions prevailed during the later half of the month, while in others heavy rains attending local storms gave precipitation near or above the seasonal average. There was an abundance of sunshine, and, excepting in sections where the rainfall was deficient, the conditions were very favorable for planting, to growing crops, and to cultivation. At the close of the month it was generally considered that the season was behind the average.

SPECIAL TELEGRAPHIC REPORTS.

[Weather Bureau, Boston.]

Week ending June 2. — New England. Boston: Cool, cloudy, showery weather prevailed until the last few days, which were warm and favorable.

Week ending June 9. — New England. Boston: Fair and warm weather prevailed during the week, except at the close, which was cool, with light showers.

Week ending June 16. — New England. Boston: Clear weather prevailed. Temperatures were low the first part of the week, with frosts reported in some places. Temperatures were seasonable afterwards.

Week ending June 23. — New England. Boston: The weather was seasonable and favorable. Light to moderate showers occurred and were beneficial.

NOTICES OF MEETINGS AND PUBLIC GATHERINGS.

Poultry.

Poultry Conference and Field Meeting of the State Poultry Association. — To be held at the Massachusetts Agricultural College, July 29, 30 and 31. Every live poultryman should attend.

Summer Field Meeting of the Board of Agriculture. — The date has been set for the summer field meeting of the Board. Friday, August 1, is the day, the Barnstable Fair grounds the place, the State Grange and the Barnstable County Agricultural Society are the co-operating organizations. Some of the best speakers of this State and other States will be on the program, and some excellent talks and demonstrations may be expected. Many years have elapsed since the Board has held a meeting in this particular part of the State, and this should be a rousing one. It will be well worth the necessary time and effort to be present at this meeting. A program will be sent upon application to this office.

State Grange Field Days. — Arrangements have been completed for the annual series of summer field meetings of the Patrons of Husbandry of Massachusetts, and the complete schedule is given below, one of these big meetings having been arranged within easy reach of all the Patrons of the State. This is a very extensive series of State Grange field meetings, and great enthusiasm and interest mark their preparation in every case.

Each meeting will be held under the joint auspices of the State Grange and the local Pomona Grange.

The locations are all central, and many of them among the best farms in the State. Good speaking, music and other features at every field day. General basket dinner, sports and a good time for every one. A big vacation resting day in the midst of the summer's work. A good investment for everybody who attends. The meetings are: —

Wednesday, July 23, Danvers, at the Dudley P. Rogers farm.

Thursday, July 24, Winchendon, at Lake Dennison.

Friday, July 25, Waban, at the Boston Market Garden farm.

Saturday, July 26, Pembroke, at Mayflower Grove.

Monday, July 28, Cummington, on the Fair grounds.

Tuesday, July 29, Fitchburg, at Whalom Park.

Wednesday, July 30, Westborough, at Lake Chauncy.

Thursday, July 31, Colrain, at Hillside Park.

Friday, August 1, Barnstable, on the Fair grounds in conjunction with the summer field meeting of the State Board of Agriculture and field day of the Barnstable County Agricultural Society.

Saturday, August 2, Acton Center, on the Acton Common.

Monday, August 4, Springfield, at Forest Park.

Tuesday, August 5, Athol, at Brookside Park.

Wednesday, August 6, Billerica, at the farm of De Lacy Corkum.

Thursday, August 7, Greenwich, at the farm of George Loux.

Saturday, August 9, Lakeville, at Lakeside Park.

Tuesday, August 12, Leominster, at the farm of J. Henry Johnson.

Wednesday, August 13, at Canobie Lake, near the city of Lawrence.

Thursday, August 14, Berkshire, at the farm of George Ingalls.

Friday, August 15, Greenfield, at Shattuck Park.

Tuesday, August 19, Russell, at Riverside Grove.

Wednesday, August 20, West Brookfield, at the farm of John H. Webb.

Thursday, August 21, Sunderland, at the farm of Dr. M. H. Williams.

Friday, August 22, Foxborough, at Lakeview Park.

Wednesday, August 27, Monterey, at Turner's Landing, Lake Buell.

Among the speakers at the summer field meetings will be the following well-known people, and all will bring a live message for the Patrons of Massachusetts: —

Hon. Oliver Wilson of Illinois, master of the National Grange; Hon. N. P. Hull of Michigan, lecturer of the National Grange; Mrs. Eva S. McDowell of Wellesley, treasurer of the National Grange; Hon. C. S. Stetson, master of the Maine State Grange and chairman of the executive committee of the National Grange; Hon. John W. Weeks, United States Senator from Massachusetts; Hon. Gifford Pinchot of Washington, D. C.; Congressmen Augustus P. Gardner, Thomas C. Thacher and Allen T. Treadway; Elmer A. Stevens, treasurer of the Commonwealth; Dr. David Snedden, State Commissioner of Education; Prof. F. W. Rane, State Forester; Wilfrid Wheeler, Secretary of State Board of Agriculture; Frank D. Kemp, of the State Highway Commission; George H. Graham, of the State Fish and Game Commission; representatives of the State Agricultural College at Amherst; J. E. Warren, supervisor of rural schools; Rufus W. Stimson, director of agricultural education; State Master Charles M. Gardner, State Overseer Edward E. Chapman, State Lecturer Evan F. Richardson, State Chaplain Rev. Evan F. Wheelock and other well-known speakers.

SUMMARY OF GENERAL CROP CONDITIONS.

In the circular to general crop correspondents, returnable June 27, the following questions were asked: —

1. What insects are proving most injurious in your locality? (Name in order of greatest damage done.)

2. Give condition of Indian corn (100 representing normal). What is the acreage as compared with normal (give per cent)? Increase; decrease.

3. (*a*) Has haying begun? (*b*) What is the hay crop prospect (100 representing normal)?

4. (*a*) Compared with normal, what is the acreage of early potatoes (give per cent)? Increase; decrease. (*b*) What is the prospect for the crop (100 representing normal)?

5. (*a*) How do early market-garden crops compare with normal (give per cent)? In yield; in price. (*b*) What is the prospect for those not yet harvested (100 representing normal)?

6. How does the supply of dairy cows compare with one year ago (give per cent)? Increase; decrease.

7. (*a*) How does the production of the following dairy products compare with that of one year ago (give per cent)? Milk: increase; decrease. Cream: increase; decrease. Butter: increase; decrease. (*b*) What is the average net wholesale price, per can of 8½ quarts, received for milk? What is the average retail price per quart? How do these prices compare with those of one year ago?

8. What is the condition of pasturage in your locality (100 representing normal)?

9. What is the outlook for such of the following fruits as are grown for market (100 representing a normal crop)? Apples, pears, peaches, plums, strawberries, currants, gooseberries, raspberries, blackberries, cranberries.

10. Have you had damaging frosts since the last report (May 24)? If so, give date or dates, temperatures, crops damaged and extent of damage.

Returns were received from 121 correspondents, and from them the following summary was compiled: —

Insects.

The month of June has brought into prominence a greater number of insects, a total of 25 different kinds being reported. As might be expected, the tent caterpillar, reported so generally last month as doing the most damage, is again named this month by 69 correspondents. The caterpillars had practically ceased operations at time of making returns, but the leafless trees attested only too plainly to the havoc wrought. The worst injury is reported from Berkshire, Hampshire, Franklin and Plymouth counties, in order named. The potato beetle is reported by 55 correspondents, chiefly in the four western counties. Bristol, Norfolk and Barnstable, with their sandy soils, and crops more susceptible to its attacks, are suffering most from the ravages of the cut-worm, this insect being mentioned by 52 correspondents. The brown-tail moth is working principally in Middlesex, Essex, Norfolk, Worcester and Plymouth, with 26 reports; while the gypsy moth, with 18 reports, is most prevalent in Essex, Middlesex, Norfolk and Worcester counties. The squash bug and striped cucumber beetles are feeding on the gourds of Hampden, Bristol, Middlesex, Essex and Worcester, with 14 returns. Cabbage worms in Norfolk and Plymouth, cranberry fire worms in Barnstable, rose chafers in Essex and Plymouth, green apple aphids in Bristol and Hampden, onion maggots in Hampshire and Essex, forest tent caterpillars in Barnstable, Hampshire and Hampden, canker worms in Franklin, elm-leaf beetles in Berkshire, Norfolk and Worcester, and others, are mentioned.

Indian Corn.

Corn is late from one to two weeks, owing to cool dry weather, which not only restrained farmers from planting early but retarded germination. At time of making returns the crop was small but growing well. The condition is: Nantucket, 100; Barnstable, 95.8; Plymouth, 90.7; Dukes, 90; Hampden, 89.7; Bristol, 86.8; Hampshire, 86.5; Essex, 86; Franklin, 85.7; Worcester, 83.8; Middlesex, 82.5; Berkshire, 76.2; Norfolk, 75; the State, 85.6. The acreage is: Franklin, 101.5; Essex, 101.2; Dukes and Nantucket, 100; Worcester and Hampshire, 99.5; Hampden, 99; Middlesex, 98; Barnstable, 97.5; Berkshire, 96.1; Bristol, 94.5; Norfolk, 94; Plymouth, 81; the State, 98.6.

The Hay Crop.

Haying has begun in every county, although very little had been done in Berkshire. Of the 121 replies to this question, 82, or 67.8 per cent, were in the affirmative, and 39, or 32.2 per cent, in the negative. This is a larger percentage of affirmative returns than in any of the past ten years. Of those reporting "yes," 23, or 28 per cent, stated that "very little" or "hardly any" had been done. A rough estimate of the extent to which farmers had begun cutting may be derived from the percentage of returns to this effect, by counties, in order, as follows: Norfolk, Dukes and Nantucket, 100; Bristol, 91; Plymouth, 88.8; Middlesex, 84.7; Barnstable, 83.3; Franklin, 77; Hampden, 70; Worcester, 60; Essex, 50; Hampshire, 40; Berkshire, 10. Grasslands did not get enough rain in June to offset, in spite of the warm sunshine, the effects of the cool cloudy weather of May. Old mowings in particular have not sufficiently recovered from the droughts of the last few years to bring the average condition of all grasslands up to anywhere near normal. The hay crop prospect is: Bristol, 88; Middlesex, 85.3; Essex, 84.7; Plymouth, 83.1; Worcester, 82.9; Hampshire, 82; Hampden, 80.8; Norfolk, 80; Dukes, 75; Barnstable, 74.1; Franklin, 72.5; Berkshire, 70; Nantucket, 60; the State, 79.8.

Early Potatoes.

The acreage of early potatoes is: Worcester, 100.6; Middlesex, Plymouth, Dukes and Nantucket, 100; Berkshire, 98.6; Hampshire, 95; Barnstable, 94; Essex, 93; Franklin, 92.8; Norfolk, 90; Bristol, 89.3; Hampden, 71; the State, 96.9. The crop is later than normal, and some pieces are reported as just showing above the ground. The vines are growing well, however, and from the returns of those correspondents who do not consider the crop too little advanced for purposes of estimate the following summary is derived: Berkshire and Nantucket, 100; Plymouth, 98.2; Norfolk, 93.8; Essex, 93; Middlesex, 92.2; Hampshire, 91.6; Hampden, 90.8; Franklin, 89.2; Bristol, 86; Worcester, 84.2; Barnstable, 76.7; Dukes, 75; the State, 89.3.

Early Market-garden Crops.

Comparatively little market gardening is done in the western counties, and kitchen gardens had not yielded enough for many correspondents to form an estimate as to either quantity or price. Very full returns from the truck sections are at hand, and the summary of the eastern counties is consequently the more reliable. The yield has been: Nantucket, 100; Hampshire, 98.7; Bristol, 96.7; Essex, 95; Plymouth, 93.6; Barnstable, 91.9; Berkshire, 90; Hampden, 86.7; Worcester, 86.1; Middlesex, 84.2; Franklin, 82.5; Norfolk, 78.8; Dukes, no return; the State, 90.1.

While the yield was below normal, prices have ruled high, and there prevails a sentiment of fair crops and good prices. The average prices, as compared with normal, are: Middlesex, 105; Worcester, 104.3; Hampshire, 103.8; Essex, 102.5; Barnstable, 102; Franklin, 101.6; Nantucket, Plymouth, Norfolk, Hampden and Berkshire, 100; Bristol, 93.1; Dukes, no report; the State, 101.1. The early market-garden crops not yet harvested promise even better yields than those already marketed, the returns reflecting the influence of better growing conditions. Crop prospect estimates are: Hampshire, 102.5; Dukes and Nantucket, 100; Barnstable, 98; Plymouth, 95.8; Franklin, 95; Norfolk and Berkshire, 93.7; Essex, 93.3; Hampden, 93; Bristol, 90; Middlesex, 89.5; Worcester, 85.5; the State, 92.5.

Dairy Cows.

During the past year the supply of dairy cows has decreased 6.8 per cent for the State, as a whole, with the most marked falling off in Nantucket, Hampden and Middlesex. The supply most nearly approaches that of last year in the county of Plymouth. From that of one year ago the supply has decreased as follows: Dukes, 25; Hampden, 14.1; Middlesex, 12.2; Franklin, 10.4; Nantucket, 10; Norfolk, 8.3; Berkshire, 7.5; Worcester and Barnstable, 4.2; Essex, 3.8; Bristol, 3.6; Hampshire, 2.5; Plymouth, 1.2; the State, 6.8. So long as dairymen continue to dispose of their herds the supply will follow the decline in the demand.

Dairy Products.

The production of milk, cream and butter has not decreased in proportion to the cow supply decline; in fact, cream production has increased in a few counties. With 100 representing the quantity of milk produced one year ago, the production on June 27 was: Dukes, 110; Berkshire, 107.2; Plymouth, 100; Hampshire and Barnstable, 98.8; Bristol, 98.5; Worcester, 97.8; Essex, 95; Hampden, 94.2; Nantucket, Norfolk and Franklin, 90; Middlesex, 84.4; the State, 96.2. For the State, as represented by the five western — the chief producing — counties, cream production has increased .3 per cent, and is: Hampden, 113.3; Franklin, 100.8; Berkshire, 100; Worcester, 97.7; Hampshire, 91.7; the State, 100.3. The butter-making figures as compared with one year ago are: Hampshire, 98.8; Franklin, 97; Hampden, 96.7; Berkshire, 95.8; Worcester, 93.8; the State, 96. The conclusion, from a study of all the returns, may run something as follows: dairy cows are in less supply because the demand has decreased, as a result of farmers discontinuing, for other pursuits, the production of milk. The amount of milk made has fallen off because dairymen have sold their herds, and because more milk is skimmed for the butter and ice-cream factories, as shown by the increase in cream production. The butter decrease may be due to a decline in the farm-made product, without consideration of the factory, or it may mean absolute aggregate decrease. The dairy business as necessarily conducted by the majority of Massachusetts farmers is the least profitable branch of their operations, and many within the past six years have discovered the fact and sold out. Many others, nevertheless, realizing that animal husbandry is fundamental to the maintenance of soil fertility, continue to face a small profit, or even a deficit, in order that their money crops may not suffer. For the sake of the business of farming let us not forsake the dairy cow!

Milk Prices.

Milk is wholesaled at different rates to city and town distributors, bakeries, stores and individuals, so that returns vary between such wide limits as 20 cents and 51 cents per can of 8½ quarts. Prices also depend upon the distance from market, the relative supply and the retail price as fixed according to the wealth and particular requirements of the consumer. Note that the following wholesale price averages reflect all these conditions separately, or in combination, as do the retail price averages given later: Plymouth, 48.3 cents; Bristol, 43.5; Barnstable, 43.3; Norfolk, 40.8; Essex, 40.2; Middlesex, 39.5; Hampden, 38.1; Hampshire, 36; Worcester, 34.9; Berkshire, 31.6; Franklin, 28.6; Dukes and Nantucket, no report; the State, 37.8.

Retail prices have advanced 1 or 2 cents per quart in some places within the past year. Outside of Suffolk County, which, if reported, would probably lead the list, average retail prices are: Nantucket, 9 cents; Norfolk, 8.75; Plymouth, 8.5; Essex, 8.25; Barnstable, 8.2; Bristol, 8.04; Dukes, 8; Middlesex, 7.9; Worcester and Hampden, 7; Berkshire, 6.9; Hampshire, 6.8; Franklin, 6; the State, 8.4.

Pasturage.

As compared with the last three or four years pasturage is in much better condition, although still far from normal. The condition is: Dukes, 100; Hampshire, 97; Worcester, 92.7; Bristol, 91.5; Essex, 90.6; Middlesex, 90.4; Plymouth and Nantucket, 90; Franklin, 88.5; Barnstable, 88.3;

Hampden, 85.8; Norfolk, 83.6; Berkshire, 78.8; the State, 89.6. Rain is badly needed for such upland pastures as are not supplied with springs, and many of our pastures are so scantily sodded that frequent rainfall is necessary to keep them in grazeable shape.

Fruits and Berries.

The berry crop prospect rather exceeds that for tree fruits. Blackberries, in particular, bloomed full and offer promise of a 91.5 per cent crop. Pears far exceed the other large fruits, while plums are rated lowest, owing to light bloom and frost. At present the outlook for apples is discouraging, and doubtless reflects the depressing effect of the sight of countless trees stripped by tent caterpillars. The damage has in reality been done to wild trees and trees not cared for, while those sprayed suffered only from frost damage to the bloom.

The fruit crop prospect table is printed in the special summary of fruit crop conditions.

Frosts.

Frosts occurred June 7 to 10 in all counties save Essex, Norfolk, Dukes and Nantucket. Temperatures ranged from 22° F. to 38° F. The most severe damage was done in Berkshire and Franklin counties, where grass, corn and nearly all vegetables were damaged. Worcester County correspondents report slight damage. Middlesex crops suffered more, with "great damage to early market-garden crops" in one locality, while frost "killed the strawberry crop" in another, and cut beans, tomatoes, potatoes and vines in other sections. Reports of damage in other counties are few and slight injury done.

NOTES OF GENERAL CROP CORRESPONDENTS.

[Returned to us June 27.]

Berkshire County.

Williamstown (S. A. Hickox). — Tent caterpillars are proving most injurious at the present time. Condition of Indian corn is 90 per cent of normal; acreage, 80. It is hard to tell whether the grass crop will recover from the dry weather; it will depend upon conditions during the next ten days; old meadows are now doomed. Haying has not begun, and the prospect is 75. The acreage of early potatoes is 90 per cent of normal. It is too early to give definite information about market-garden crops. The supply of dairy cows has decreased 10 per cent over one year ago, with a corresponding decrease in the supply of milk, cream and butter. Average net wholesale price of milk is 34 cents per can; at retail, 7 cents per quart. These prices are normal. The outlook for the following fruits compared with normal is: apples, 20; pears, 20; strawberries, 20; currants, 30; raspberries, 30; blackberries, 60. Frosts have injured beans, corn, potatoes and all market-garden crops badly; apples and all small fruits were nearly ruined.

North Adams (C. M. Ottman). — The tent caterpillar, potato beetle and cutworm are doing the most damage. Indian corn, condition, 75; acreage, 90. Haying has begun and the prospect is for 70 per cent of a normal crop. Acreage of early potatoes is 75 per cent of normal; the crop will be about normal. Early market-garden crops about 80 per cent of the normal in yield; 100 per cent in price; those not yet harvested promise a 100 per cent crop. The supply of dairy cows has increased 10 per cent over one year ago. There has been a corresponding increase in the production of milk and cream. Average net wholesale price for milk is 34 cents per can; retail price, 7 cents per quart. These prices are identical with those of a year ago. Condition of pasturage is 90. The outlook for the following fruits is: apples, 25; pears, 15; plums, 10; strawberries, 15; currants, 40; gooseberries, 40; raspberries, 90; blackberries, 100. On June 10 the temperature dropped to 30°. The hay crop is very light and there is very little fruit except raspberries.

Hancock (D. L. Whitman). — Potato beetles are doing the most damage. Indian corn, condition, 95; acreage, 100. The hay crop prospect is 65 per cent and operations have not commenced. The acreage of early potatoes has increased 15 per cent; the crop prospect is 110. Very few market-garden crops grown here; prospect for these is 100. The supply of dairy cows has decreased 10 per cent over last year; there has been a corresponding decrease in the production of milk and butter. Milk prices, 30 cents per can at wholesale; 5 cents per quart at retail. The prices are about the same as usual. Condition of pasturage, 80. Fruit outlook is: apples, 65; pears, 70; plums, 60; currants, 60. On June 8 and 9 the temperature dropped to 30°, and beans and tomatoes were killed. So far it has been a cold, dry season.

Cheshire (L. J. Northup). — The Colorado potato beetle is doing the most damage. Indian corn, condition, 70; acreage, 100. Haying has not commenced, and the prospect is for about a 40 per cent crop. The acreage of early potatoes remains about the same. It is rather early to make an estimate of the crop. Early market-garden crops are about 100 per cent in yield and in price; the prospect for those not harvested is 100. The supply of dairy cows has decreased 20 per cent over last year. The production of milk has decreased 15 per cent and butter the same amount. The average net wholesale price of milk is 30 cents per can; the retail price per quart is 8 cents. These prices are the same as usual. Condition of pasturage is 60. Strawberry outlook is 75. Do not remember any damaging frosts of late.

Windsor (HARRY A. FORD). — The tent caterpillar is doing the most damage. Indian corn is 80 per cent of normal in condition and the acreage is 100. Haying has not begun; if we do not get rain soon the crop will not be over 75. The acreage of early potatoes is 90 per cent as compared with normal. Very few market-garden crops raised. The number of dairy cows is growing smaller each year, the number this year being about 90 per cent of the number in 1912. The supply of milk has decreased proportionately. Milk retails at from 5 to 8 cents per quart. Condition of pasturage, 100. The apple crop will be about 25 per cent of normal, owing to the frosts; blackberries, 100. On June 8 and 9 the temperature dropped to 32° in some places, and potatoes and nearly everything else were cut down.

Peru (F. G. CREAMER). — Haying has not begun yet, and the prospect is for about a 75 per cent crop. The supply of dairy cows has decreased 25 per cent over last year. Condition of pasturage is good. The early frosts injured the hay crop. Apples look well.

Washington (E. H. EAMES). — Very little insect damage as yet. Indian corn, 50 per cent of normal in condition, and the acreage is 75 per cent of normal. It is too early to estimate the potato crop. The supply of dairy cows is about the same as last year, and dairy products are about the same. The net wholesale price of milk is 34 cents per can; retail, 7 cents per quart. These prices are about the same as a year ago. Pasturage is about 50 per cent of normal. Apples promise only a 50 per cent crop. There have been no frosts since the last report.

Lee (E. J. NORMAN). — The tent caterpillar, the pine-tree rust, the elm-leaf beetle and the cutworm are doing a good deal of damage. Indian corn is very late, condition, 50. The acreage is about 115. Haying has not begun; the prospect is for a light crop on account of dry weather; compared with last year, 75. The acreage of early potatoes has been increased 25 per cent. It is too early to estimate the potato crop. Early market-garden crops, 90 per cent of normal in yield, 100 per cent in price. The prospect for those not yet harvested is 75; possibly better if we get rain. The supply of dairy cows is about the same as one year ago. Milk retails at 8 cents per quart, which is a raise of 1 cent over a year ago. Condition of pastures, 80. The fruit outlook is: apples, 45; pears, 45; plums, 5; strawberries, 25; currants, 90; gooseberries, 80; raspberries, 90; blackberries, 90. On June 8 and 9 the temperature dropped to 32° and 33°. Tomatoes, potatoes, beans, cucumbers and squashes were damaged from 25 to 75 per cent. The month has not been very satisfactory. During the early part it was cold, and at present it is hot and dry with a good deal of wind.

Becket (W. H. Snow). — The potato beetle and caterpillars are doing the most damage. Indian corn, condition, 100; acreage, 105. Haying has not begun as yet; prospect is 75. The acreage of early potatoes is 95. Early market-garden crops are about 90 per cent in yield, and are very late. The supply of dairy cows has decreased 10 per cent during the last year. The supply of milk and cream is about the same as usual. The average retail price of milk is 7 cents per quart, which is an increase of 1 cent over a year ago. The fruit outlook is: apples, 90; pears, 90; strawberries, 100; currants, 100. Corn, potatoes, tomatoes, squashes and cucumbers, as well as most other crops, were damaged by frosts. We had a very dry May.

Franklin County.

Rowe (Henry D. Wright). — Indian corn, condition, 50. The acreage is 75 per cent of normal. Haying has not begun; the prospect is 60 per cent. I think the frost has injured the hay crop. The acreage of early potatoes is about normal. The supply of dairy cows has decreased 25 per cent over one year ago; there has been a corresponding decrease in milk production. The condition of pasturage is 100. Apples promise a 50 per cent crop, while the strawberry crop was practically ruined by frosts.

Colrain (W. H. Davenport). — The tent caterpillar has been very bad, but damage is about past; canker worm has done some damage. Indian corn, condition, 90; acreage, 110. Haying has not begun; the crop will not be over 75. The acreage of early potatoes is 75 per cent of normal; the prospect is not over 50. Early market-garden crops, about 50 per cent of normal in yield; the prospect for those not harvested is poor. The supply of dairy cows is about the same as one year ago. Milk retails for 6 cents per quart. Condition of pastures, 75. The fruit outlook is: apples, 60; pears, few; peaches, few; plums, few; strawberries, 50; currants, gooseberries, raspberries and blackberries, few. There was a frost on June 7, but not a very heavy one. The weather nearly all of the month has been cold, dry and backward.

Leyden (Frank R. Foster). — The acreage of Indian corn is about normal. Haying has just begun; the crop promises about 55 per cent of normal. The acreage of early potatoes is 100 and the prospect is also 100. Early market-garden crops are about normal in yield and price, and the prospect for those not harvested is 100. The supply of dairy cows has decreased 25 per cent during the last year. The production of milk and cream is about the same as one year ago, but the production of butter has increased 10 per cent. Condition of pastures, 80. The fruit outlook is: apples, 60; pears, 100; peaches, 100; strawberries, 40; raspberries, 100; blackberries, 100. On June 9 and 10 the temperature fell from 32° to 34°, and frosts cut early potatoes, beans and corn and greatly damaged the hay crop.

Hawley (C. F. Sears). — Indian corn, condition, 75; acreage, about normal. Prospect for the hay crop, 60. Haying has not begun. The acreage of early potatoes is about normal and the prospect for the crop is 100. The supply of dairy cows and the amount of milk produced has decreased 5 per cent since one year ago. Milk prices are the same as usual. Pasturage condition, 80. The fruit outlook is: apples, 50; currants, 75; raspberries, 75; blackberries, 100. Frost on June 8 did considerable damage to the hay crop.

Buckland (Eugene D. Griswold). — The tent caterpillar is doing the most injury. Indian corn is about 100 per cent in condition, although a trifle late; acreage, compared with normal, is 100. There has been very little haying done; grass is now growing well, but the crop will be about 80 per cent of normal. Acreage of early potatoes is normal; it is difficult to tell what the prospect is, as they were set back by frosts. Pastures, condition, 85. The fruit outlook is: apples, 75; pears, 80; peaches, 90. June 10 was very cold; frost damaged potatoes and corn in some parts of the town and spoiled nearly all of the gardens.

Montague (A. M. Lyman). — Tent caterpillars, cutworms and potato bugs seem to be doing most damage. Indian corn, condition, 90; acreage, 100. Haying has begun; the crop prospect is about 80. Compared with normal the acreage of early potatoes is 110; the prospect for the crop is about 90. Early market-garden crops are about 90 per cent of normal in yield, 100 in price; those not yet harvested promise 90. The supply of dairy cows has decreased 10 per cent over one year ago. There has been a corresponding decrease in the production of milk, cream and butter. The average net wholesale price of milk is 25 cents per can; at retail, 5 cents per quart. These prices are about the same as one year ago. Condition of pasturage, 80. The fruit outlook is: apples, 50; pears, 50; peaches, 40; plums, 40; strawberries, 60; raspberries, 25; currants, 80; blackberries, 40. The hard frost of June 10 did much damage to asparagus. The above shrinkage on fruit and berries is due to frost. There has been but little rain since May 1, which has shortened the hay crop 40 per cent. Pastures are very short.

Sunderland (George P. Smith). — Larvæ of potato beetles are numerous. Indian corn, condition, 88. The acreage is about normal. Haying has begun, but not much has been cut; prospect is 85; good on rich, new seeding, old fields short. The acreage of early potatoes is about normal; the prospect for the crop is 90. Early market-garden crops are about 90 per cent in yield and 105 per cent in price, and the prospect for those not harvested is 95. The supply of dairy cows has decreased 5 per cent during the last year. The supply of milk is about the same, but the cream supply has decreased about 5 per cent. The average wholesale price of milk is 30 cents per can; retail price per quart, between 5 and 6 cents, which is a slight increase over a year ago. Pasturage condition, 95. The fruit outlook is: apples, 70; pears, 85; plums, 50; strawberries, 75; currants, 85; raspberries, 60; blackberries, 90. Tobacco is all set and stand is good, with growth normal. Onions are late but growing rapidly; some fields are thin.

New Salem (Daniel Ballard). — Most injurious insects are tent caterpillars and potato bugs. The condition of Indian corn is 75; acreage is normal. Haying has begun and the crop will be about 70 per cent of normal. The supply of dairy cows is as usual. The wholesale price paid for milk per can is 34 cents, and it retails for 6 cents per quart. These prices are a trifle higher than one year ago. Condition of pastures is 90. The fruit outlook is: apples, 100; pears, 90; strawberries, 85. Frosts did a little damage to gardens in low places in early June.

Hampshire County.

Plainfield (C. A. Williams). — Tent caterpillars are doing the most damage, and the potato bug next. Condition of corn is 90; its acreage is 110. Farmers have not begun haying; the prospect is for 80 per cent of a normal crop. The acreage of early potatoes is normal, and the prospect is for a 90 per cent crop. Early market-garden crops show 95 per cent of a normal yield; prices are 110; the prospect for those not harvested is 110. There is a decrease of about 10 per cent in the supply of dairy cows, and the supply of milk, cream and butter has decreased accordingly; 6 cents per quart is the price paid for milk at retail, which is about the same as last year. Pastures are about normal. The fruit outlook is: apples and pears, 75; peaches, 50; plums, 85; raspberries and blackberries, 100. No frosts since May 28. The cold month of May and late frosts have put most crops back, and the dry weather has also hurt them.

Goshen (George L. Barrus). — Tent caterpillars have been the most injurious insects, but the potato beetle is now coming. The condition of corn is 90; the acreage is 85. Haying has not been commenced. The frosts hurt grass on low lands, and the crop looks rather light. There is a 5 per cent increase in the acreage of all potatoes, and there is a prospect for a 100 per cent crop. Dairy cows continue in the same supply as a year ago. No wholesaling of milk done; retail price is 6 cents per quart, which is the same as a year ago. Pastures are in normal condition. The fruit outlook is: apples, 75; pears, plums, strawberries and blackberries, 100. No serious frosts.

Chesterfield (HORATIO BISBEE). — Tent caterpillars have been very plentiful and have set back the leaves on apple trees. Indian corn is in 90 per cent of a normal condition; its acreage is 100. No haying has been done yet: frosts in May and the cold, dry weather have put it back, and have reduced the prospects to a 70 per cent crop. Early potatoes will yield a normal crop. The supply of dairy cows shows a decrease of 10 per cent, and there are corresponding decreases in the production of milk and cream. Pasturage is in normal condition. The fruit outlook is: apples, 60; wild blackberries, 120. There have been frosts which killed tomatoes, beans, etc. Corn was planted late; came up well, and is looking good, but is small. Potatoes and other crops are backward, with a prospect of a very light crop of hay. Frosts hurt apples on low grounds. The wild blackberry bloom was very full.

Westhampton (LEVI BURT). — No serious damage has been done by insects in this vicinity. The condition of corn is 75, with acreage normal. Haying has not been started; prospect is for 80 per cent of a normal crop. Milk is selling for the same prices as last year. Pasturage is in normal condition. The fruit outlook is: apples and pears, 50; peaches, 25; strawberries, 50; currants, 100.

South Hadley (W. F. PERSON). — No insect damage is noticed except that done by potato bugs. The condition of Indian corn is about 75; its acreage is normal. No one is haying to any extent. The hay crop will be about 90 per cent of normal. The early potato acreage is about 75. The crop is very late. All market-garden crops are late, but are good — 100 per cent — in yield, and are selling at normal prices. Those not yet harvested promise a 100 per cent yield. The supply of cows is about the same as last year; production of milk is 90 per cent of that of a year ago; wholesale price of milk is 6 cents per quart, and this commodity retails for 8 cents, which is 1 cent higher than a year ago. Pasturage is 90 to 100 per cent of a normal in condition. The fruit outlook is: apples, 50; pears, 75; strawberries, 90; raspberries, 75; blackberries, 90.

Hadley (H. C. RUSSELL). — The most troublesome insects are tent caterpillars, currant worms, cutworms and potato bugs. The condition of Indian corn is 90, and the usual acreage has been planted.

Haying has been started and there is promise for 80 per cent of a normal crop. A 10 per cent greater acreage of early potatoes has been planted, and the crop promises to be as usual. In yield. market-garden crops are 100; in price, 105. The prospect for those not yet harvested is 100. The number of dairy cows is 5 per cent less than a year ago, with a corresponding decrease in dairy products. The average net wholesale price paid for milk is 30 cents per can; the average retail price per quart is 6 cents. These prices show a 5 per cent increase over those of one year ago. Pasturage is in 90 per cent condition. The fruit outlook is: apples and pears, 110; peaches and strawberries, 50; currants, 75; blackberries, 50.

Amherst (WILLIAM P. BROOKS). — Onion maggots and cutworms are proving most injurious. Corn is backward; its condition is 90; the acreage is normal. Haying has begun and the crop will show a 100 per cent yield. A normal acreage of early potatoes has been planted, and the prospect is for a 90 per cent crop. Yields and prices of early market-garden crops are about normal, and the prospect for those not yet harvested is the same. There is no marked difference in the supply of dairy cows between now and a year ago, and the same may be said of dairy products. Milk retails for 8 cents per quart, which is the same price received a year ago. Condition of pastures is 100. The fruit outlook is: apples and pears, 75; peaches, 100; plums, 50; strawberries, 75; currants, raspberries and blackberries, 100.

Greenwich (WALTER H. GLAZIER). — The most injurious insects are cutworms. The condition of corn is 95; the acreage has been increased 10 per cent above normal. No haying has been done as yet; there is a prospect of a 95 per cent crop. The supply of dairy cows is about the same; the price of milk per can is 32 cents; per quart at retail, 6 cents. These prices are about the same as those one year ago. In the early part of June a hard frost cut crops badly. Planting has been late, but everything is looking quite well. There will be no fruit in this town to speak of, as the May frosts destroyed the bloom.

HAMPDEN COUNTY.

Blandford (ENOS W. BOISE). — The most injurious insect has been the tent caterpillar, with potato beetles most troublesome at present. The corn crop is in 90 per cent condition, and a normal amount has been planted. Very little haying has been begun; the prospect is for 85 per cent of a normal crop. A normal acreage of early potatoes has been put in. Early market-garden crops show a yield of 80, but are selling for normal prices; those not yet harvested will be 90 per cent crops. The number of dairy cows has been decreased 20 per cent over a year ago. Milk and cream production has fallen off 10 per cent, while butter production has decreased 20 per cent. Milk sells for 45 cents per can at wholesale and 7 cents per quart at retail, which prices prevailed a year ago. Pasturage is in 90 per cent condition. The fruit outlook is: apples, 50; pears, 40; peaches, 50; plums, 10; strawberries, 50; currants, raspberries and blackberries, 90.

Russell (E. D. Parks). — The most troublesome insects are the tent caterpillars and currant worms, while the potato beetles are just coming on in very great numbers. Corn is in 90 per cent condition; the acreage is 85 per cent of normal. Haying has commenced; the prospect is for an 80 per cent crop. The number of early potatoes planted has been increased 5 per cent, and there is prospect for an 80 per cent crop. In both yield and price early market-garden crops are 90 per cent of a normal, and those not yet harvested will yield 95. The supply of dairy cows has increased 20 per cent; the production of milk shows a 10 per cent increase, while cream and butter show 5 per cent increases. Milk is selling for 34 cents per can at wholesale and for 6 cents per quart at retail, the same prices having been received a year ago. Pasturage has been in very good condition, but is now drying up very fast. The fruit prospect is: apples, 85; pears, 90; peaches and plums, 85; strawberries, 60; currants, 90; raspberries and blackberries, 90, if we have rain.

Southwick (L. A. Fowler). — The elm-leaf beetles and potato bugs are proving most injurious. In both condition and acreage, Indian corn is normal. Hardly any haying has been begun; there will be a 90 per cent crop. Early potatoes show a 10 per cent increase in acreage. No noticeable change is evident in the supply of cows, but there is an increase of 10 per cent in the production of cream. The average net wholesale price paid for milk per can is 47 cents; that paid per quart is 7 cents, which prices prevailed one year ago. Pastures are in 100 per cent condition. The fruit outlook is: apples, 100; pears, 60; strawberries, 25; raspberries, 80.

West Springfield (N. T. Smith). — Indian corn is in 80 per cent condition; its acreage is 90 per cent of a normal. Very little has as yet been done. There is indication of a 75 per cent crop, but this prospect may improve if rains are abundant. The acreage of early potatoes has decreased 10 per cent; the prospect is favorable if the crop is carefully cared for. Early market-garden crops have yielded 85 per cent of normal, but are bringing normal prices. With favorable weather the prospect for those not yet harvested might be called 100. By the report of the cattle inspector, dairy cows have decreased 14 per cent; milk production has decreased 12 per cent; this product is sold for 4½ cents per quart wholesale, and 8 cents per quart retail, just the same as one year ago. Pastures are in 75 per cent condition. The fruit outlook is: apples, good; pears, set heavily; peaches, very few; strawberries, very short crop; raspberries and blackberries, promising. The apple trees in this town are mostly dead.

East Longmeadow (JOHN L. DAVIS). — The codling moth, potato beetle, tent caterpillar, cutworm, wire worm and squash bug are the most injurious insects. The condition of Indian corn is 80; its acreage is 90. Haying has begun and there is prospect for a 60 per cent crop. The early potato acreage is about normal; prospect for the early crop is 75; that for the late potato crop, 100. In yield, early market-garden crops are 80; in price, 10 per cent higher than normal; the prospect for those not harvested is 100. The dairy cow supply shows an increase of 10 per cent, and milk production has been increased in the same degree. The wholesale price paid for milk per 10-quart can is 4¼ cents per quart, which is the same as last year. Pastures are in 80 per cent condition. The fruit outlook is: apples and pears, 50; peaches. 20; plums, 40; strawberries, 60. Frosts on about June 10, for two nights in succession, damaged beans, peas, tomato plants, some corn and potatoes and also strawberries.

Wilbraham (H. M. BLISS). — The condition of Indian corn is 75 to 80. The acreage is 90. Farmers have not begun haying; the hay crop prospect is 85 to 90. Compared with normal the acreage of early potatoes is 80 per cent, being an increase of 5 per cent over last year; crop prospect is 90. Early market-garden crops, in comparison with normal, are about 85. The supply of dairy cows has decreased 25 per cent over one year ago, with a corresponding decrease in the production of milk, cream and butter. The wholesale price of milk is 35 cents per can, 8 cents per quart at retail. These prices are about the same as a year ago. The fruit outlook is: apples, 85; pears, 90; peaches, 70; strawberries, 80; currants, 75. The temperature has several times dropped to freezing, and once dropped to between 25° and 30°, doing great damage to peaches. The season is very backward; some planted corn and potatoes only last week.

Monson (F. D. ROGERS). — Potato bugs, striped cucumber beetle, squash bugs, tent caterpillars and cutworm have been very plentiful. Indian corn, condition, 100; acreage, compared with normal, 110. The hay-crop prospect is 80, but no harvesting has been done as yet. The production of dairy products is practically the same as that of one year ago, although the number of cows is on the decrease. The retail price received for milk is 7 cents per quart. Condition of pasturage, 90. The fruit outlook is: apples, 25; pears, 75; peaches, 25; strawberries, 50; gooseberries, 75; raspberries, 100; blackberries, 100. Frosts have done considerable damage since date of last report.

Hampden (E. Norton Davis). — Cutworms, apple aphis, potato beetle, flee beetle, striped squash bug and the rose chafer are doing much damage. Indian corn, condition, 80; acreage, about normal. Haying has barely begun; the crop prospect is 75. The prospect for garden vegetables is 80. Dairy cows remain about the same in numbers, although there has been a decrease of about 10 per cent in the amount of milk produced and an increase of 20 per cent in butter. Average net wholesale price of milk, 34 cents per can; average retail price, 5 cents per quart. These prices are about the same as usual. Condition of pasturage is 85 to 90 per cent of normal. The prospect for the apple crop is 40; peaches, 10. No damage from frosts to speak of.

Worcester County.

Athol (Clifford H. Smith). — All kinds of insects are plentiful this year. Condition of Indian corn, 75. The acreage has been increased about 20 per cent above normal. Haying has just begun; crop prospect is 80. The acreage of early potatoes is about 110 per cent of normal; the crop prospect is 65. Market-garden crops 55 per cent of normal in yield, 100 in price; those not yet harvested, prospect, 90. Supply of dairy cows is about the same as one year ago. There has been about a 10 per cent decrease in milk production, 10 per cent increase in cream production and 25 per cent decrease in the amount of butter made. The average wholesale net price of milk is 50 cents per can; the average retail price per quart is 8 cents. These prices are the same as a year ago. Condition of pasturage in this locality, 40. The fruit outlook is: apples, 40; plums, 20; strawberries, 60; raspberries, 75; blackberries, 75.

Gardner (W. E. Knight). — Cutworms are the most injurious. Condition of Indian corn, 90; acreage, about normal. Haying has begun and the prospect is 85 per cent for the crop. The acreage of early potatoes is about normal; the crop prospect, 85. Dairy products are about the same in amount as one year ago; wholesale price received for milk, 35 cents per can; retail price, 7 cents per quart, which is about the same as a year ago. Condition of pasturage, 75. Fruit prospect: apples, 65; pears, 90; raspberries, 85. There have been no damaging frosts since the last report.

Fitchburg (Dr. Jabez Fisher). — Haying has not yet been begun; crop prospect is 75. Condition of pasturage is 80 per cent of normal. Fruit outlook is: apples, 70; pears, 100; strawberries, 60; grapes, 80. Cold, dry winds have not favored vegetation, even with good sunshine.

Hubbardston (Charles C. Colby). — Tent caterpillars and brown-tails are most in evidence. Indian corn, condition, 90; acreage, about normal. Haying has begun and the prospect for the crop is 75 to 80. Acreage of early potatoes is about normal; the prospect for the crop is 90. Dairy cows have decreased 10 per cent in the last year. The production of milk has decreased from 8 to 10 per cent. The average wholesale price per can is 31 to 33 cents; the average retail price per quart is 6 cents. These prices are about the same as last year. Pasturage, condition, 100. The apple prospect is about normal.

Dana (LYMAN RANDALL). — Cutworms, tent caterpillars and potato bugs are most injurious. Indian corn, condition, 60; acreage, 100. Haying has not begun; the prospect for the crop is 80. Early potato acreage is about the same as last year; prospect for the crop is hard to tell as yet; although somewhat backward they are looking well. Market-garden crops are late and probably about 75 per cent of normal in yield; about normal in price; those not yet harvested promise about 75. The supply of dairy cows is about the same as one year ago, and the production of dairy products has not changed. Milk retails at 8 cents per quart, which is about the same as one year ago. Pasturage, 75. Fruit prospect: apples, 25; pears, 50; peaches, 10; strawberries, 10; raspberries, 75; blackberries, 40; cranberries, 80. About the 1st of June we had severe frosts; nearly all crops were damaged more or less.

New Braintree (CHARLES D. SAGE). — Very little damage is being done by insects just now; elm-leaf beetles causing some trouble. Indian corn, condition, 80. Haying has begun, and the prospect is for an 80 per cent crop. The acreage of early potatoes is about 90 per cent of normal; prospect for the crop is about 90. There is no increase in the number of dairy cows. It is almost impossible to get reliable help on the farm, and with the low price of milk farmers are discouraged and want to get out of the dairy business. There has been a decrease of 10 per cent in the production of milk during the past year, cream, 20 per cent, butter, 20 per cent. Although it is hard to average the price of milk, I should say at wholesale it is 32 cents per can; at retail, 7 cents per quart. The condition of pasturage is about 85, the severe droughts for the past two years having injured the sward. The fruit prospect is: apples, 75; pears, 50; plums, 50.

West Brookfield (MYRON A. RICHARDSON). — The elm-leaf beetle, tent caterpillar, cutworm and potato bug are proving most injurious. Acreage of Indian corn is about normal, although there is a slight increase. No haying has been done; the crop prospect is 75. The acreage of early potatoes is about the same as usual; it is too early to give figures in regard to the crop. Dairy cows are scarce and high. The milk production is smaller than a year ago; average price per can, 30 cents, which is somewhat lower than a year ago. Pasturage condition, 60. The outlook for fruits is: apples, 60;

pears, 90; strawberries, 100; currants, 90; blackberries, 100. No frost damage during June.

North Brookfield (John H. Lane). — Tent caterpillar, Colorado potato beetle and striped squash bug are doing the most damage. Indian corn, condition, 90; acreage, about normal. Hay crop prospect is 60, and haying has commenced. The acreage of early potatoes is 100 and the prospect for the crop, 75. Prospect for market-garden crops is 75, although they are somewhat late; in price, 120; prospect for those not yet harvested, 75. The number of dairy cows is about 90 per cent as compared with one year ago. The production of milk has decreased about 5 per cent during the last year; price per can, 34 cents wholesale; 7 cents per quart at retail. Condition of pasturage, 60. The fruit crop prospect is: apples, 10; pears, 10; plums, 10. The May frosts proved very injurious to fruits, and the caterpillars destroyed much of what the frosts left.

Southbridge (E. T. Torrey). — Tent caterpillar and cutworm lead the insect destroyers. Condition of Indian corn is 100, and the acreage is about normal. Very little haying has been done as yet; hay crop prospect, 120. Prices for market-garden crops are about normal; prospect for those not harvested, 110. The supply of dairy cows is about equal to that of one year ago; the production of milk is about 125 per cent as compared to that of a year ago; average wholesale net price, 40 cents per can; retail price, 7 and 8 cents per quart, this being nearly 1 cent higher than last year. Condition of pastures, 150. Fruit crop prospect: apples, 80; strawberries, 100; blackberries, 110.

Leicester (H. H. Kingsbury). — Most damage is being done by potato beetles and squash bugs; the tent caterpillar has been very destructive, but now is in the inactive stage. Condition of Indian corn, 90; acreage, about normal. No haying has been done as yet; crop prospect, 85. Acreage of early potatoes 140 per cent compared with normal; the prospect for the crop is indefinite at the present time. Average net wholesale price of milk is 40 cents per can; average retail price, 8 cents per quart. Dairy products are about the same as one year ago; the number of cows is also about the same. Apples and pears promise a 90 per cent crop. No frost injury has been noticed during the past month.

Sutton (H. L. Ray). — The tent caterpillar has been doing the most damage. Indian corn, condition, 75; compared with normal the acreage is 65. Very little haying has been done; prospect for the crop, 90. Very few early potatoes grown in this section. Prospect for market-garden crops, 75. Dairy cows and their products are about the same as one year ago; milk prices, wholesale, 34 cents per can; retail, 6 cents per quart. These prices are about the same as last year. Condition of pasturage is 90. The outlook for fruits is: apples, 50; pears, 90; peaches, 25; strawberries, 75.

Southborough (Edward F. Collins). — The most injurious insects at present are potato bugs and cucumber bugs. Condition of corn is 95; acreage, about 90 per cent of normal. Haying has begun and there will be a 100 per cent crop. The acreage of early potatoes is about 90 per cent of normal; prospect for the crop. 100. Market-garden crops about normal in yield; in price, 105. The supply of dairy cows has decreased about 10 per cent during the past year, with a corresponding decrease in the milk production; wholesale price for milk, 38 cents per can; retail price, 8 cents per quart; these are 10 per cent less than one year ago. Condition of pasturage in this locality, 100. The fruit crop prospect is: apples, 10; pears, 100; peaches, 10; plums, 100; strawberries, 100; currants, 100; raspberries, 100.

Sterling (Henry S. Sawyer). — The brown-tail and gypsy moths are doing most damage in this locality. Condition of Indian corn, 75. Hay crop prospect, 90; haying is under way. The acreage of early potatoes is 90 per cent of normal; prospect for the crop is 90. Early market-garden crops not harvested, and the prospect for the crop is rather doubtful. The supply of dairy cows is about the same as last year, as also is the supply of dairy products. The price of butter has increased 2 cents per pound; the net wholesale price of milk is 32 cents per can; retail price. 7 cents per quart. These prices are about the same as usual. Pasturage condition, 100. The fruit outlook is: apples, 50; pears, 50; peaches, 25; plums, 25; strawberries, 25; currants, 50; raspberries, 25.

Lancaster (J. F. Brown). — Cutworms are the most injurious insects. Indian corn, condition, 80; acreage, 100. Haying has begun, and the prospect for the crop is 85; old fields seem very light. Prospect for the potato crop is good. Early market-garden crops are about 90 in yield; 100 in price; the prospect for those not yet harvested is 85. The supply of dairy cows has decreased 10 per cent since last year. Pasturage condition, 100. The fruit outlook is: apples, 80; pears, 100; peaches, 75; gooseberries, 100; raspberries, 100; blackberries, 100. On June 6 the temperature was 30° in low sections, and 36° in the uplands.

Middlesex County.

Townsend (G. A. Wilder). — The most injurious insects are the tent caterpillar, brown-tail and gypsy moth and elm-leaf beetle. Indian corn is in 85 per cent condition and the acreage is normal. Haying has begun; the prospect is for a 75 per cent crop. The acreage of early potatoes is about the same as usual, and there will be an 80 per cent crop. Compared with normal, early market-garden crops show a 75 per cent yield and are from 15 to 25 per cent higher in price. The prospect for those not yet harvested is 75. Compared with one year ago, the supply of dairy cows shows a decrease of 10 per cent. There has been a decrease of 10 per cent in the production of both milk and cream and a decrease of 15 per cent in that of butter. The retail price of milk averages 7 cents. Pasturage is in 85 per cent condition. The fruit outlook is: apples, pears, peaches and plums, 25; strawberries, 50; currants, 40; gooseberries, raspberries and blackberries, 25; cranberries, 45. There have been damaging frosts.

Westford (J. W. Fletcher). — Gypsy moths are doing the most damage. The condition of Indian corn is 85; acreage has been increased 10 per cent. Haying has not begun; the prospect is for 90 per cent of a normal crop. The acreage of early potatoes is 75 per cent of normal. Dairy cows are in about the same supply. Milk is selling wholesale at 32 cents per can and retail at 6 cents per quart, the same as one year ago. Pasturage is in 90 per cent condition. The fruit outlook is: apples, 50; pears, 75; strawberries, 80; raspberries, 100; blackberries, 25.

Billerica (E. F. Dickinson). — Caterpillars, brown-tail moths and gypsy moths are proving most injurious. The condition of Indian corn is 90; the acreage is 110. Haying has begun and there will be 85 per cent of a normal crop. There is a normal acreage of early potatoes and the crop is looking well but is late. Early market-garden crops show 75 per cent of a normal yield; prices are normal. The prospect for those not yet harvested is 80. Milk sells for 36 cents per can of 8½ quarts and retails at 7 cents per quart, which prices prevailed one year ago. Pastures are in 100 per cent condition. The fruit outlook is: apples, 55; pears, 75; peaches, 40; plums, 35; strawberries, 80; currants, 75. The frost on June 10 did slight damage to corn, beans and tomatoes; the temperature was 38° F. For all outdoor vegetables this is a late season. Tree fruits, however, are rather earlier than usual, and apples are large for this date.

Stow (Geo. W. Bradley). — The most injurious insects are the tent caterpillar and the brown-tail and gypsy moths. The condition of corn is 50; its acreage is 75. Haying has commenced, with a prospect for an 80 per cent crop. Early potatoes have increased 25 per cent in acreage. The prospect is for a yield of 75 per cent. Dairy cows have decreased 25 per cent in supply. Milk production has decreased 50 per cent; butter production, 25 per cent. Forty cents per can is the price paid for milk sold at wholesale, while the retail price received is 6 cents per quart, which are about the same as a year ago. Pasturage is in 80 per cent condition and needs rain. The fruit outlook is: apples and pears, 50; peaches, 10; strawberries, 50; currants, 25; raspberries, 50; blackberries, 75.

Maynard (L. H. Maynard). — Tent caterpillars have done the most damage in this section; cutworms and potato beetles are very numerous. Corn is backward, but its condition is 90; its acreage is 100. Farmers have started haying with an outlook for a 100 per cent crop. A normal acreage of early potatoes has been put in, and there will be a normal crop. In both yield and price early market-garden crops are normal, and the prospect for those not yet harvested is the same. Pasturage is in 100 per cent condition. The fruit outlook is: apples, 75; pears, 50; plums, 100; strawberries, 25; other small fruits, 100. We had a heavy frost the first of the month which practically killed the strawberry crop and was of great damage to early market-garden crops.

Marlborough (E. D. Howe). — Tent caterpillars, brown-tail and gypsy moths, cutworms and potato beetles are doing the greatest amount of injury. The condition of Indian corn is 95. The amount planted is normal. Farmers have started in haying, with a prospect for a 99 per cent crop. The acreage of early potatoes is 100, and there is prospect for a 100 per cent crop. Early market-garden crops not yet harvested promise a 95 per cent yield. The dairy cow supply has fallen off 2 per cent. Milk is selling at 38 cents per can at wholesale and at 8 cents per quart retail. These prices prevailed a year ago. The condition of pastures is 100. The fruit outlook is: apples, 50; pears, 95; peaches, 50; plums, 100; strawberries, 90; gooseberries, 100; blackberries, 100. This is a better season for grass than last year.

Hopkinton (W. V. Thompson). — The insects that are working the most havoc are tent caterpillars, brown-tail moth and squash bugs. Indian corn is in 80 per cent condition, and the acreage is about 100. Haying has begun; the prospect is for a 90 per cent yield. Dairy cows continue in about the same supply, with about the same amount of milk produced. Milk is sold for 28 cents per can at the car, while the average retail price per quart is 7 cents. These prices are just the same as a year ago. Pastures are in fair condition, 80. The fruit outlook is: pears, strawberries, raspberries and blackberries, 100. The season started early, but crops are all of ten days late.

Newton (G. L. Marcy). — Potato beetles are proving the most injurious. Not much haying has been done; there is promise of an 80 per cent crop. The prospect is for a normal crop of early potatoes. Early market-garden crops germinated poorly; prices rule good. Those not yet harvested will yield 90. There is a falling off of 10 per cent of the supply of dairy cows, with a similar decrease in the production of milk, which sells from 40 to 50 cents per can wholesale and 9 cents per quart retail. These prices are the same as those realized a year ago. Pastures are in 100 per cent condition.

The fruit outlook is: pears, plums and strawberries, 100; blackberries and cranberries, limited.

Lincoln (C. S. Wheeler). — Tent caterpillars and brown-tail moths have done the most injury but are now gone. Both kinds of squash bugs are now busy. The condition of corn is 90; the acreage is 95. Very little haying has been done. The hay crop prospect is 95. With no change in the acreage of early potatoes, the promise is for a normal crop. In yield, market-garden crops are 80; in price, 100; those not yet harvested will give a 100 per cent yield. The supply of dairy cows has decreased 10 per cent, while the production of milk has fallen off in the same degree. The average net wholesale price per can received for milk is 39 cents, while this commodity brings 10 cents per quart at retail. These prices show no great change over those of a year ago. Pastures are in 100 per cent condition. The fruit outlook is: apples, 55; peaches, 50; strawberries, 75; currants, 70; gooseberries, 60; blackberries, 60.

Winchester (S. S. Symmes). — The most troublesome insects are tent caterpillars, brown-tail moths and leopard moths. Grass is being cut, but there will not be over a 75 per cent crop. Grass roots have been winterkilled in many places. In yield, early market-garden crops are 75; in price, 100. Those not yet harvested promise only a 75 per cent crop. The ground is rather dry. There has been a decrease of 25 per cent in the supply of dairy cows, and the same decrease pertains to milk. The average net wholesale price of 50 cents per can is realized for milk, while 10 cents per quart is the average retail price. These prices are the same as a year ago. All milk raised is sold locally. Pasturage is in 50 per cent condition. The fruit outlook is: apples, 75; pears and peaches, 100; plums, 25; strawberries and currants, 50. On June 9 frost cut beans and tomato plants in places; the temperature was 38° F.

Essex County.

Methuen (Frederick A. Russell). — Those insects proving most injurious are brown-tail moths, tent caterpillars, gypsy moths, asparagus beetles, forest bugs and potato beetles. Very little Indian corn is raised. The condition of sweet and ensilage corn is 100. Haying has not begun; the prospect offered is for a 75 per cent crop. A falling off of 20 per cent in the acreage of early potatoes is noticeable. The yield promised is 75 per cent of a normal. Early market-garden crops show a 100 per cent yield, and are getting a 110 per cent price. Those not yet harvested promise to be 100 per cent crops. Cows are in normal supply, as is milk. This product brings 38 cents per can wholesale and 8 cents per quart retail. The same prices prevailed a year ago. Pastures are in normal condition. The fruit outlook is: apples, 50; pears and peaches, 150; strawberries, 75. Market-garden crops, requiring hot weather, are not looking as well as usual, and late-sown cabbage is not germinating well on account of dry weather.

Merrimac (S. Bixby Sargent). — Gypsy moths are proving the most troublesome insects. The condition of Indian corn is 80; as compared with normal, there is a slight increase in acreage. Haying has begun and the prospect for the crop is 90. There is not much change in the acreage of early potatoes; the prospect for the crop is 100. The supply of dairy cows has decreased. The average net wholesale price for milk is 40 to 45 cents per can, and the retail price is 8 cents per quart. The condition of pastures is about the same as usual, not especially good, anyway. Pheasants have done considerable damage by pulling corn.

Groveland (A. S. Longfellow). — Gypsy moths, potato bugs, onion maggots and cutworms are the most troublesome insects. Indian corn is in 95 per cent condition, while the acreage is normal. No haying has been done; there is a promise of an 80 per cent crop. The acreage of early potatoes has been decreased 25 per cent; the crop prospect is 90. As compared with one year ago, milk supply has decreased 10 per cent. Cans are selling for 37 cents wholesale, and the retail price is 8 cents per quart. The wholesale price is slightly lower than last year. The condition of pasturage is 75. The fruit outlook is: apples, 25; pears, 80; peaches and strawberries, 75; raspberries, 90.

Newbury (Geo. W. Adams). — The most injurious insects are the brown-tail moth, tent caterpillar and gypsy moth. The condition of corn is 80; the acreage is 105. Farmers have commenced haying, with a promise of an 85 to 90 per cent crop. The acreage of early potatoes has increased 10 per cent. There is a prospect for a normal crop. Early market-garden crops have yielded 90 and have brought 100 per cent prices. There is a good prospect for those not yet harvested. There are apparently more dairy cows, but in reality there is a 5 per cent decrease. Milk production has fallen off 10 per cent; the supply of cream is about the same, with a slight decrease in the production of butter. Milk prices average higher than a year ago. Pastures are in 90 to 100 per cent condition. The fruit outlook is: apples, 100; pears, 80; peaches, 100; plums, 90; strawberries, 90; other small fruits, 100. It is impossible to get at the prices on milk, as hardly any two producers sell under the same conditions. Local prices vary from 6 to 8 cents per quart. A little wholesaled at Boston contractors' prices.

Topsfield (B. P. Pike). — Gypsy and brown-tail moths and potato beetles appear to be producing the greatest havoc. In both condition and acreage Indian corn is 100. Haying has begun, with an 80 per cent crop prospect. There is an average acreage of early potatoes; the prospect is for a 100 per cent crop. Market-garden crops have yielded normally and sold at normal prices; those not yet harvested promise 100 per cent yield. The supply of dairy cows has decreased 10 per cent, as has milk production. This commodity wholesales for 38 cents per can, which is the price received one year ago. Pastures are in 90 per cent condition. The fruit outlook is: apples and pears, 80; peaches, 100; strawberries, 80; blackberries, 100.

Hamilton (Geo. R. Dodge). — Cutworms, potato beetles and rose chafers are proving to be the most injurious insects. The condition of corn is 75; its acreage is 100. No haying has been done; the prospect is for an 85 per cent crop. Late potatoes show an acreage of about 85 per cent. In yield, early market-garden crops are 90; in price, 100. Those not yet harvested promise 80. The supply of dairy cows is the same as one year ago, and milk production has remained the same. The price per can received for milk is 45 cents; the retail price is 9 cents, which prices prevailed last year. Pastures are in about 85 per cent condition. The fruit outlook is: apples, 25; pears, 75; peaches, 50; plums, 10; strawberries, 50; currants and gooseberries, 75; raspberries, 80; blackberries, 95.

Norfolk County.

Dover (Lewis B. Paine). — The worst insect pest is the cutworm. The condition of corn is 75; the acreage is 100. Haying has begun, with a prospect of 50 per cent on old land and 80 per cent on new seeded fields. Early potatoes offer a 100 per cent prospect. Early market-garden crops have yielded 80, with prices ruling about as usual. All market-garden crops not harvested are growing well and promise a 90 per cent yield. Dairy cows have decreased 10 per cent in the last year and there has been a similar reduction in the production of milk. This product wholesales for 34 cents per can and retails at 9 cents per quart. The wholesale price is 1 to 2 cents higher than last year. Pasturage is in 60 per cent condition. The fruit outlook is: apples, pears and peaches, 50; strawberries, 75; currants, 60; raspberries and blackberries, 80.

Norwood (Frank A. Fales). — The most troublesome insect pests are the brown-tail moths, cutworms and potato beetles. Indian corn is looking well, with an acreage of 90. Haying has begun with promise for an 80 per cent crop. The early potato acreage is 20 per cent below normal; the promise is for a 75 per cent yield. Early market-garden crops have produced 60 per cent and sold at 90. Those not harvested will be 85 per cent crops. As compared with a year ago, dairy cows are 15 per cent less in supply. A corresponding decrease is noted in milk. The wholesale price received for milk is 42 cents per can, while the average retail price is 9 cents per quart. These prices show increases of 2 cents per can and 1 cent per quart. Pasturage is in 75 per cent condition. The fruit outlook is: apples, 75; pears, 50; strawberries, 80; currants, 90. The hay crop on old land was injured by the dry spell in 1912. The season is two to three weeks late on account of the cold, wet spring.

Wrentham (JEREMIAH A. COBB). — On trees the elm-leaf beetle is doing the most damage, while crops are suffering principally from the cutworms and Colorado beetle. Indian corn is late, just coming up; the acreage is normal. Haying was begun from a week to ten days earlier than usual; the prospect offered is for a 100 per cent crop. In family gardens potatoes are looking well. Dairy cows continue in the same supply, and milk and cream have not changed within the past year. Milk wholesales for 38 to 40 cents per can, while the retailers get 8 cents per quart. These prices are the same as last year. Condition of pastures is 100. The fruit outlook is: apples, 75 to 80; pears, 100 to 125; peaches, 300 to 400, — best in years; plums, 25 to 35; strawberries, 75; currants, 100; gooseberries were frozen and there are none; raspberries and blackberries, 100. The season is two weeks late for cultivated crops, but the hay crop is early.

Foxborough (WM. E. PERKINS). — The condition of corn is 75. The acreage is 80. Haying has commenced, with an 80 per cent prospect. The original number of cows is kept. Milk wholesales for 45 cents per can and retails for 8 cents per quart, which prices are the same as last year. Pastures are in normal condition. The fruit outlook is: apples, pears and peaches, 100; plums, 50; strawberries, 75; other small fruits, 100. The spring has been rather cold and backward and crops are not up to the normal. An unusual number of cutworms have damaged garden crops in most places.

Cohasset (ELLERY C. BATES). — The worst insect pest this season has been the tent caterpillar. Haying has begun, and that cut indicates a 75 to 85 per cent crop. The acreage of and prospect for early potatoes are 100. In both yield and price early market-garden crops are 100, while a normal prospect is offered for those not harvested. Dairy cows, milk and cream are in normal supply. Milk brings 45 cents per can at wholesale and 8 to 10 cents per quart retail, which are the normal prices. Pastures are in 100 per cent condition. The fruit outlook is: apples, pears and strawberries, 50.

BRISTOL COUNTY.

Mansfield (E. JASPER FISHER). — Cutworms and potato beetles seem to be doing the greatest amount of damage. The Indian corn acreage has been decreased 25 per cent, while the crop is in only 70 per cent condition. Very little haying has been done as yet;

there is promise for a 75 per cent crop. The prospect for the very few early potatoes raised is 90. Early market-garden crops have yielded 85 per cent, and the prices are good. Those not yet harvested promise 90 per cent crops. Cows are in about the same supply as last year. Milk brings 45 cents per can wholesale, and 8 cents per quart retail, which are about the same, practically, as a year ago. Pastures are in 75 per cent condition. The fruit outlook is: apples, 70; pears, 80; plums, a failure; strawberries, 75; raspberries, 90; blackberries, 100; cranberries, 90. Some frost was reported but no damage.

Attleborough (Isaac Alger). — The most troublesome insects are the potato beetles. The condition of corn is 90; the acreage is 100. Haying has not begun; prospect is for 95 per cent of a normal crop. The early potato crop prospect is 85. Early market-garden crops have yielded 100, while those not harvested promise a normal yield. The supply of cows and the production of milk continue normal. The wholesale price per can for milk is 50 cents per 10 quarts; the retail price ranges from 7 to 9 cents. The fruit outlook is: apples, 85; pears, 100; strawberries, 110; cranberries, 100. At the farm we get 60 cents per 10-quart can of milk.

Rehoboth (Harold A. Goff). — Cutworms and potato bugs are doing the most insect injury at present. Indian corn condition is 100; acreage shows a 5 per cent increase. Haying has begun, with a promise of a 70 per cent crop. The early potato acreage has been increased 10 per cent. The crop offers a 95 per cent promise. Early market-garden crops have yielded 100, and good prices have prevailed; those still growing promise 95 per cent yields. The dairy cow supply has decreased 5 per cent, and milk production has fallen off 10 per cent. The wholesale price received for milk per can of 8 quarts is 50 cents, while the retail price is 8 and 9 cents. These are about the same prices as ruled a year ago. The condition of pastures is 80. We have had many hard winds which blew a lot of fruit from the trees.

Swansea (F. G. Arnold). — Tent caterpillars have raised the most havoc. In both condition and acreage Indian corn is normal. Farmers have commenced haying, with the prospect of taking off a 75 per cent crop. The acreage of early potatoes has decreased 25 per cent; the crop prospect is 90. In yield, early market-garden crops have been 100 and in price, 90; those not yet harvested promise 80 per cent crops. The supply of cows has fallen off 10 per cent, but milk production continues the same as one year ago. This commodity wholesales for 44 cents per can and retails for 9 cents per quart. These prices show advances of 4 cents per can and 1 cent per quart over those of one year ago. Pastures are in normal condition. The fruit outlook is: apples, 50; pears, 75; peaches and strawberries, 80.

Acushnet (M. S. Douglas). — The most troublesome insects are the potato beetles and cutworms. Indian corn is in 50 per cent condition, with a normal acreage planted. Haying has begun, and the promise is for a 75 per cent crop. Early potatoes show an acreage increase of 25 per cent, and offer a crop prospect of 80. Early market-garden crops have furnished a normal yield and brought 90 per cent prices; those not harvested promise an 80 per cent yield. Dairy cows are in the same supply as last year and milk and cream production have increased 5 per cent. Milk is wholesaled for 51 cents per can and retails for 8 cents per quart, which prices are the same as last year. Pasturage is in 100 per cent condition. Fruit outlook is: apples and pears, 75; peaches, strawberries, raspberries and blackberries, 100. There was frost on June 10.

Fairhaven (D. W. Deane). — The most troublesome insects are the cutworms and striped beetles. Indian corn is in 90 per cent condition; its acreage is 85. Haying has begun with the prospect of a 60 per cent crop. The early potato acreage is 80 and the prospect is the same. Early market-garden crops show an 85 per cent yield, with prices 10 per cent off; those still growing promise to yield 95 per cent. The dairy cow supply and milk production have increased 10 per cent over one year ago. Cream and butter are in normal supply. Milk at wholesale brings 50 cents per can, while the retail price is 8 cents per quart. These prices are the same as last year. Pasturage is in 90 per cent condition. The plum outlook is 90. In fact, the outlook for all fruits is good, but they are so late in blooming that the prospect for the set cannot be estimated.

Plymouth County.

Brockton (Davis Copeland). — Green cabbage worms, cutworms, cucumber beetles and rose bugs are the insects which are proving most injurious. The condition of corn is 80; the acreage is 100. Little haying has been done as yet; the prospect is 75. The acreage of early potatoes is 100, and the prospect is for a normal crop. Early market-garden crops have yielded 75, and there is promise that those not harvested will give the same yield. The dairy cow supply shows a falling off of 10 per cent. Milk wholesales for 45 cents per can. The condition of pasturage is 75. The outlook for apples, pears, peaches, strawberries and blackberries is 100.

Norwell (Henry A. Turner). — The most troublesome insects are tent caterpillars, cutworms and brown-tail moths. Haying has begun; hardly enough has been cut for one to form an estimate. Early potatoes are late, but are coming up at last. Strawberries are bringing more than the usual price. Dairy cows are in about the same supply as last year. Milk brings 8 cents per quart retail, which is a slight rise over last year. The condition of pasturage is 90. The fruit outlook is: apples, 50; pears and peaches, 75; plums, 50; strawberries, 100. Crops have suffered from frost, but very little.

Hanover (HARRISON L. HOUSE). — Tent caterpillars, cutworms and potato beetles seem to be the most injurious insect pests. The condition and acreage of corn is 100. Haying has hardly begun; there is promise of an 85 per cent crop. The early potato acreage is normal, with the prospect of a 90 per cent yield. Compared with normal, early market-garden crops are 100 in both yield and price, and those not harvested offer the same prospect. Dairy cows remain in the same supply, and production of milk, cream and butter has not changed from last year. The average retail price per quart for milk is 8 cents, which is the same as one year ago. No dairy farms in this town wholesale milk. The condition of pasturage is 90. The fruit outlook is: apples, 50; pears, 100; peaches, strawberries and currants, 75; cranberries, 100.

Marshfield (L. C. BARTLETT). — The most injurious insects are the cutworms and tent caterpillars. The condition and acreage of corn is 100. Haying has begun, with the prospect for a normal crop. There is a normal acreage of early potatoes, and a prospect for a 100 per cent crop. Early market-garden crops have yielded 100 per cent, and it is expected that those not harvested will yield likewise. The dairy cow supply and milk production continue normal. Milk sells at retail for 8 cents per quart, the same as last year. The condition of pasturage is 100. The fruit outlook is: apples, 100; pears, 50; peaches, 100; plums, 50; strawberries, 100.

Plympton (WINTHROP FILLEBROWN). — The most damage by insect pests is being done by tent caterpillars, potato bugs and gypsy and brown-tail moths. The condition of Indian corn is 90; the acreage is 110. Farmers have begun cutting hay; the crop will be about 80 per cent. There is a normal acreage of early potatoes. Early market-garden crops have yielded 105 and have sold for 100. Those still in the ground will furnish normal crops. The dairy cow supply and milk production are normal. Milk wholesales for 45 cents per can and retails at 9 cents per quart, which is 1 cent higher than one year ago. The condition of pastures is 105. The fruit outlook is: apples, 95; pears, peaches, plums, strawberries, currants, blackberries, raspberries and cranberries, 100; gooseberries, 90. Frosts on June 9 and 10 did some damage.

Carver (J. A. VAUGHAN). — Most insect damage is being done by the tent caterpillars and currant worms. The condition of corn is 100; the acreage is 75. No haying has been done as yet; the prospect is for a normal crop. Early market-garden crops yielded 75 and realized normal prices. The condition of pasturage is 75. The fruit outlook is: apples and pears, 75; plums, 50; strawberries, 75; currants, 50; gooseberries, 75; cranberries, 100.

Wareham (A. B. Savary). — Tent caterpillars are about the only ones that are doing much harm. Indian corn is in 90 per cent condition with a normal acreage planted. Haying has begun, with the prospect for a 75 per cent crop. The early potato crop prospect is 100. Normal crops and prices prevail in the case of early market-garden truck, and that not harvested promises a normal yield. Milk retails at 10 cents per quart, there being no change from last year. Pastures are in 100 per cent condition. The fruit outlook is: apples, 60; pears, 100; peaches, 90; plums, 80; strawberries and currants, 100; gooseberries, 90; raspberries, blackberries and cranberries, 100.

Barnstable County.

Bourne (Robert S. Handy). — The forest tent caterpillar, the common tent caterpillar, cranberry fireworm, cutworm and maggot prove to be doing the most injury. In both condition and acreage Indian corn is 100. Haying has begun, with the prospect for a 60 per cent crop. The acreage of early potatoes is 150, with a 75 per cent prospect. Early market-garden crops have yielded normally and have brought normal prices, while those not harvested promise 100 per cent crops. Dairy cows are in normal supply. Milk sells at retail for 10 cents per quart, which is the same price as last year. Condition of pasture is 60. The fruit outlook is: strawberries, 90; cranberries, 75. On June 9 frost with a bog temperature of 26° damaged cranberries 50 per cent.

Sandwich (Henry F. Hoxie). — The most injurious insects are the potato beetle, cutworm and the cranberry fireworm. The condition and acreage of corn is 100. Farmers have begun haying with an 80 per cent prospect. A normal acreage of early potatoes has been planted, and a normal crop is promised. In yield, early market-garden crops have been 110, with prices, 100; those still growing promise normal yields. The supply of dairy cows has increased 10 per cent, and milk production in the same degree. The wholesale price realized for milk is 45 cents per can. The retail price is 7 cents per quart, just the same as last year. Pasturage is in 90 per cent condition. The fruit outlook is: apples and pears, 100; peaches, 75; plums, strawberries, currants, gooseberries and raspberries, 100; cranberries, 110. The hay crop was evidently damaged by a dry spell here when the grass was getting started. Pasturage is light for want of rain.

Dennis (Joshua Crowell). — The most troublesome insects seem to be the common and forest tent caterpillars. Condition of corn is 90; acreage is 95. Farmers have begun haying, with the prospect for a 75 per cent crop. The early potato acreage has been slightly increased. There is a prospect for an 85 per cent crop. Early market-garden crops have yielded 80 and sold for 100. The prospect for those still growing is 90. The dairy cow supply has fallen off 20 per cent, while milk and cream production has decreased 10 per cent. Milk brings 7 cents per quart retail, just the same as last year. Condition of pastures is 90. Fruit outlook is: apples, 60; strawberries, 75; cranberries, looking well. Some frosts occurred in early June, but did not do much damage.

Truro (JOHN B. DYER). — The most damage by insect pests is being done by tent caterpillars, brown-tail moths and cutworms. In both condition and acreage Indian corn is 100. No haying has been done so far; the prospect is for a 100 per cent crop. The early potato acreage is 100, and the crop will be normal. Compared with normal, early market-garden crops are 100 in both yield and price, and the same may be said of those not harvested. The dairy cow and dairy product supply continues normal. Milk brings 40 cents per can wholesale and 6 cents per quart retail, about the same as last year. The condition of pastures is 125. The fruit outlook is: apples and pears, 100; peaches, 125; small fruits, 100. Some slight frosts have occurred with no particular damage.

DUKES COUNTY.

West Tisbury (GEO. HUNT LUCE). — The insects proving most injurious are potato beetle and tent caterpillar. Condition of corn is 90; the acreage, 100. Haying has begun, with the crop prospect of 75. A normal acreage of early potatoes has been planted; the crop prospect is 75. Early market-garden crops not harvested promise 100. The dairy cow supply is 75 as compared with one year ago. Milk production has increased 10 per cent; 8 cents per quart is the retail price paid for milk, about the same as last year. Condition of pasturage is 100. The fruit outlook is: apples and pears, 50; peaches, 10; strawberries and blackberries, 100; cranberries, 75. The season started very early with us, then came cold and dry weather, injuring the fruit bloom and setting back the growth of all vegetation, so that we have old meadow hay that is ripe, while timothy is backward.

NANTUCKET COUNTY.

Nantucket (H. G. WORTH). — The most injurious insect pests are potato bugs and cutworms. The condition and acreage of Indian corn are 100. Farmers have started cutting hay, with the crop prospect of 60. The early potato acreage and crop prospect are 100. Early market-garden crops have yielded normal and have brought 100 per cent prices. The same may be said of those not harvested. The dairy cow supply and milk have fallen off 10 per cent. This product retails for 9 cents per quart. This is the same price as paid a year ago. Pasturage is in 90 per cent condition. The fruit outlook is: strawberries, 90; cranberries, 100.

SUMMARY OF FRUIT CROP CONDITIONS.

In the circular to fruit crop correspondents, returnable June 27, the following questions were asked: —

1. Have frosts done noticeable damage to the following fruit crops (give dates and per cent of damage)? Apples, pears, peaches, plums, cherries, small fruits.

2. Have tree fruits set well (give per cent of blossoms set, if possible)? Has there been much drop?

3. What are the prospects for the following crops? Apple, pear, peach, plum, cherry, currant, raspberry, blackberry, blueberry.

4. What methods of cultivation are practiced in orchards in your vicinity? (*a*) Sod mulch (state whether grass is cut and removed or left on ground)? (*b*) Clean culture? (*c*) Are legumes, such as clover, cow peas, vetch or alfalfa, planted in orchards as cover crops? If not, what cover crops are used?

5. What insects are doing most damage in orchards?

6. Has fire blight appeared in any orchards?

7. To what extent was the strawberry crop injured by frost?

8. Have prices of strawberries been satisfactory? Compare with average. Compare with 1912.

9. Is summer spraying for sooty fungus or other fruit diseases practiced at all in your vicinity?

Returns were received from 67 correspondents, and from them the following summary was compiled: —

Frost Damage.

A larger number of reports upon the frost damage to fruit crops would have been productive of more accurate deductions; the following table will, however, give a reasonably correct idea of this damage. It will be noticed that plums, pears and apples were the heaviest sufferers for the State as a whole. The counties of the State, ranking them in order of greatest damage done to all fruits, were as follows: Berkshire, Hampden, Franklin, Bristol, Norfolk, Middlesex, Hampshire, Worcester and Essex equal, Barnstable and Plymouth. There were no reports on fruits from Dukes and Nantucket counties.

Damage of Fruits by Counties (Per Cent).

County.	Apples.	Pears.	Peaches.	Plums.	Cherries.	Small Fruits.
Berkshire,	60.0[1]	55.0[1]	-[2]	63.5[1]	10.0[3]	5.0[1]
Franklin,	27.8	30.7	41.6	27.1	45.7	32.8
Hampshire,	31.2	12.5	61.0[1]	38.0	-[1]	50.0[1]
Hampden,	27.0	26.2	60.0	50.0[1]	37.5[1]	11.6
Worcester,	10.0	4.0	11.0	11.0	3.8	17.0
Middlesex,	21.9	16.5	21.8	39.5	19.5	21.2
Essex,	8.7	7.1	14.2	25.0	-	1.4
Norfolk,	25.0[3]	25.0[3]	-[2]	25.0[3]	25.0[3]	-[2]
Bristol,	-[3]	-[3]	50.0[3]	85.0[3]	-[3]	25.0[3]
Plymouth,	8.2	-	3.3[1]	16.6	-	-
Barnstable,	-[3]	-[3]	-[3]	50.0[1]	-[3]	-[3]
State,	20.2	15.6	24.9	32.7	16.0	16.0

[1] Two reports. [2] No report. [3] One report.

Tree Fruits, Set and Drop.

For the State as a whole the returns indicate that the set of tree fruits was 57.7 per cent of the bloom. Frosts in Berkshire County were evidently very injurious, although the small number of reports from this county detract somewhat from the value of the deductions. The figures at hand give the per cent of blossoms which formed fruit in comparison with total bloom as follows: Barnstable, 75; Hampshire, 75; Plymouth, 71.6; Hampden, 62.5; Essex, 60; Middlesex, 57.6; Franklin, 56.2; Bristol, 50; Worcester, 47.5; Norfolk, 25; Berkshire, 5. In general, the drop has been fully an average, although many reported it as just beginning. This is doubtless due to the drought, which is now becoming felt, although frost injury caused considerable drop. It is worthy of note that several correspondents mentioned the fact that where orchards were sprayed the drop was much lighter. In Hampden, Worcester, Norfolk and Plymouth counties the drop was rather heavy; in Berkshire, Franklin, Hampshire and Essex about average; in Middlesex, Bristol and Barnstable it was lighter than usual.

Fruit Prospect.

The following table, compiled from the returns of special fruit correspondents and general correspondents combined, gives a fairly complete and accurate idea of the prospect for the different crops at the present time (100 per cent represents a normal crop): —

	Berkshire.	Franklin.	Hampshire.	Hampden.	Worcester.	Middlesex.	Essex.	Norfolk.	Bristol.	Plymouth.	Barnstable.	Dukes.	Nantucket.	STATE.
Apples,	40.5	62.9	68.0	63.8	62.2	64.5	58.3	69.7	74.5	72.7	80.0	50.0[1]	–[2]	64.04
Pears,	40.0	78.5	78.5	68.6	85.5	78.4	84.4	69.7	69.7	84.0	100.0[3]	50.0[1]	–[2]	77.03
Peaches,	30.0[1]	67.2	67.5	43.5	45.6	55.7	87.2	140.0	86.8	89.0	66.7[3]	10.0	–	70.06
Plums,	25.0	69.1	76.3	46.3	38.2	66.1	79.0	52.6	55.0[3]	75.7	100.0[3]	–[2]	–[2]	60.40
Cherries,	35.0	85.0	100.0	37.5	68.1	87.5	91.6	75.0	75.0[1]	95.0[3]	–[2]	–[2]	–	–
Strawberries,	33.8	58.1	73.0	57.1	68.0	69.6	75.0	75.8	88.8	88.7	90.0	100.0[1]	90.0[1]	81.40
Currants,	67.1	90.0	87.6	93.3	85.0	72.5	81.3	87.5	85.0	82.5	100.0[3]	–[2]	–[2]	72.70
Gooseberries,	60.0	–	–	75.0	100.0	80.8	75.0	100.0	100.0	85.0	100.0[3]	–[2]	–[2]	84.70
Raspberries,	75.5	72.7	86.7	91.9	86.6	81.8	94.0	91.3	90.0	95.0	100.0[3]	–[2]	–[2]	85.80
Blackberries,	90.0	91.0	85.0	98.3	93.6	84.2	95.8	91.3	98.3	100.0	100.0[1]	100.0[1]	–[2]	91.50
Cranberries,	–	–	–	100.0	80.0	77.5	–	–	88.3	100.0	89.0	75.0[1]	100.0[1]	89.40
Blueberries,	–[2]	80.0[1]	57.0[3]	100.0[1]	86.0	71.6	87.5[3]	100.0[1]	100.0[1]	100.0[3]	–[2]	–[2]	–[2]	84.10

[1] One report. [2] No report. [3] Two reports.

Orchard Practice.

The replies to this question are quite interesting, denoting as they do the spreading interest in and application of modern methods of orchard practice. There is still much to be done, however, in educating the growers along this line, for by far the larger number of correspondents reported that nearly all orchards in their vicinity were kept in grass and hay removed. It is high time that every fruit grower realized that both a satisfactory crop of fruit and a good hay crop cannot be taken from the same piece of ground, especially when the amount of plant food supplied is in many cases insufficient even for one. A few reported that the grass was cut and used as mulch. Some reported this practice for old orchards and clean culture for new ones. Some reported clean culture in young orchards only, in most instances, and quite a number gave this method as the prevailing one in all orchards in their vicinity, calling attention to the fact that this was the method employed by the growers who produced the best fruit. Some report the growing of strawberries or market-garden crops in orchards as the prevailing practice. The use of legumes, especially crimson clover and vetch, is quite widespread, although a number report that they are not used at all. Non-leguminous cover crops in more or less general use are rye, buckwheat and oats, used in connection with crimson clover to some extent, while many growers the latter part of the summer simply let the grass and weeds grow in the orchard.

Insects.

Several correspondents, replying to this question, called attention to the fact that the damage by insects was very small where proper spraying was practiced. The study and application of this preventive measure would mean many dollars in the pockets of those of our fruit growers who now pay little attention to insect pests until it is too late to prevent their ravages. In Berkshire County the tent caterpillar, codling moth and San José scale were reported as injurious; in Franklin, the codling moth, curculio, tent caterpillar and railroad worm were reported in the order named; Hampshire, the railroad worm, tent caterpillar, codling moth, scale and canker worm; Hampden, codling moth, curculio, scale, tent caterpillar, borers and aphis; Worcester, tent caterpillar, brown-tail, codling moth, gypsy, curculio and scale, while borers and aphids were referred to; Middlesex, gypsy, brown-tail and tent; Bristol, Plymouth and Barnstable reported the tent and the brown-tail, with one report of aphis in the latter. The work of the tent caterpillar has been appalling this year but is now about over; farmers and fruit growers will do well to heed the warning, and before another season clean out all wild cherry trees and then spray their orchards at the proper time.

Fire Blight.

Many correspondents stated that they were not familiar with this disease. The reports indicate that it is not especially prevalent. One report in Franklin County stated that it had appeared to some extent; Hampshire, 2; Hampden, 1; Worcester, 5; Middlesex, 3; Essex, 3; Plymouth, 2. All others either reported that it had not appeared or that they were not familiar with it.

Strawberries, Frost Injury.

At the time of the last report it was difficult to estimate just what the frost damage to the strawberry crop had been. The replies this month indicate that this damage was as follows: Franklin, 66; Norfolk (one report), 50; Berkshire (two reports), 47.5; Hampden, 45; Hampshire, 41.6; Worcester, 40.5; Bristol (one report), 25; Middlesex, 24.2; Essex, 12.1; Plymouth, 3.3; Barnstable (two reports), none; the State, 31.6.

Strawberry Prices.

Prices for strawberries have been very satisfactory this year, nearly every report stating that they were higher, and a number that they were way above the average run of prices. The reports from Berkshire County stated that at time of reporting it was too early to give prices as the crop had not yet been harvested. Figures received indicate that prices as a whole have been about 20 per cent higher this season than in 1912, berries which sold for from 15 to 20 cents last year bringing from 17 to 25 cents this year.

Summer Spraying.

The replies to the question as to the extent of summer spraying for sooty fungus and other fruit diseases revealed practically the same facts as were brought out in relation to orchard cultivation, namely, that the majority of fruit growers do not as yet realize the value of the results secured by this practice. Some reported that there was "no time and labor was high;" others reported "to a limited extent." The indications are, however, that although comparatively few growers now spray for these diseases during the summer, the practice is growing in favor as its results are demonstrated by the few, and it will eventually receive the attention it deserves.

NOTES OF FRUIT CROP CORRESPONDENTS.

[Returned to us June 26.]

Berkshire County.

Richmond (Henry J. Lamke). — Frost has damaged fruits as follows: apples, 80; pears, 90; plums, 50; small fruits, normal, except strawberries, which were damaged 75 per cent. Five per cent of the blossoms on tree fruits have set; there has been very little drop as there was not much to drop. Fruit crop prospect: apple, 25; pear, 10; plum, 25; currant, 100; raspberry, 100; blackberry, 100. Grass is removed from the orchard whenever there is enough to pay for cutting. Fire blight is doing some damage. The strawberry crop was damaged 75 per cent by frosts; there are very few strawberries raised for market. There is very little spraying done, as nobody has the time and labor is high.

North Egremont (R. Henry Race). — Frost has damaged the different crops as follows: apples, 90; pears, 50; peaches, 100; plums, 100; cherries, 100; strawberries, 50. Tree fruits did not set well; there has been no fruit to drop. Crop prospect: apple, total loss; pear, 50; peach, plum and cherry, practically a total loss; currant, 100; raspberry, 100; blackberry, 100; blueberry, very serious damage. The best orchards are cultivated; some are in sod; clean culture is practiced in a few orchards, but most of the orchards are neglected; legumes are used more or less as cover crops. San José scale is doing most damage; some fire blight has appeared. Strawberry prices have been very satisfactory, 20 per cent higher than in 1912. No summer spraying practiced.

Franklin County.

Conway (Alvah J. Norman). — Frost has damaged fruits as follows: peaches, 25; cherries, 70. Fifty per cent of the blossoms on tree fruits have set, and the drop has not been very heavy. Fruit crop prospect: apple, good; pear, good; peach, fair; plum, good; cherry, slight; currant, good; raspberry, good; blackberry, good. Hay is removed from orchards; very little clean culture practiced; legumes are not planted to any extent. The curculio is doing the most damage; no noticeable fire blight has appeared. Strawberry crop was injured very slightly by frosts. Spraying for sooty fungus and other fruit diseases is practiced very little. This is a splendid fruit section and considerable is grown, but the Lord raises it.

Leyden (C. F. Severance). — There has been no noticeable damage by frosts. Fruit tree blossoms set well, and there was not much drop. Fruit crop prospect: apple, 80; pear, 100; peach, 90; plum, 75; blackberry, 100; cherry, 100; currant, 100; raspberry, 75. Grass is removed from the orchards; some clean culture is practiced, and legumes are planted to some extent. The codling moth is doing the most damage; fire blight, to some extent, appeared in orchards. About 50 per cent of the strawberry crop was damaged by frosts; prices have been very satisfactory. Some spraying for fruit diseases is being practiced.

Orange (A. C. Wakefield). — Frost has damaged fruits as follows: apples, 50; pears, 40; peaches, 50; plums, 90 per cent on hills, none on low lands; cherries, 50; raspberries and blackberries, 100; there are a few strawberries left. Fruit trees set well on high lands; none set in valleys; there was a 40 per cent drop. Fruit crop prospect: apple, 35; pear, 45; peach, 40; plum, 100 on high lands; cherry, 40; not many currants raised here; raspberries and blackberries promise a full crop. Am sorry to say mostly sod is used for cultivation; grass is removed from most orchards; clean culture is practiced in a few orchards; legumes are not much planted, but buckwheat, some weeds and a little clover are used as cover crops. The codling moth, curculio and maggot are the most troublesome insects. The frost damage to strawberries was severe; in fact, there are but few strawberries left; prices quite satisfactory — 12½ cents average: prices in 1912, 15 to 17 cents per box; 1913, 20 to 25 cents per box. Very little spraying is being practiced for sooty fungus or other diseases. Peaches are all set here on high ground, so percentage of set is better than some other fruits.

Hampshire County.

Prescott (E. T. Wheeler). — Frost damaged fruits as follows: apples and pears, 25; plums, 75; small fruits, 50. One hundred per cent of the blossoms on tree fruits have set, and there has been a 25 per cent drop. Fruit crop prospect: apple, 75; pear, 75; plum, 25; currant, 100; blackberry, 100; blueberry, 25. Grass is removed from orchards; legumes are not planted, grass sod being used for cover crops. The codling moth is doing the most damage; fire blight has not appeared in orchards. Strawberries not raised in this vicinity. Summer spraying is not being practiced.

South Amherst (W. H. Atkins). — Pears and peaches on high grounds were not damaged by frosts; apples suffered a 50 per cent damage; strawberries, 25. Fruit crop prospect: apple, 25; pear, 100; peach, 100. Orchards are cultivated either entirely or in strips. Fifty per cent of the cover crops planted are legumes; weeds and grasses are also used. San José scale is doing the most damage; no fire blight has appeared. Twenty-five per cent of the strawberry crop was damaged by frost; prices have been satisfactory. Spraying is not being practiced.

Cummington (C. M. Cudworth). — Frost damaged fruits as follows: apples, more than 50; peaches, 75; strawberries were very badly damaged, and a few plums suffered. Very few apple blossoms set, and there was not more than the usual drop. Fruit crop prospect: apple, 50; raspberry, 100; blackberry, 100; blueberry, 100; pears and currants promise an average crop; peaches a light crop. In most cases grass is cut and removed from orchards; very few legumes are planted, and in most cases crops stand in sod. Caterpillars and canker worms are doing the most damage; some fire blight has appeared in most all orchards. The crop of wild berries was ruined by frosts. Strawberries are selling a little higher than in 1912. There have been so many hard frosts this spring that it is difficult to give dates of most destructive.

Hampden County.

West Springfield (Ethan Brooks). — No noticeable damage by frosts. Fifty per cent of tree fruit blossoms have set, and there has been no more than the usual drop. Fruit crop prospect: apple, 50; peach, 80; cherry, 50; currant, 80; raspberry, 100. In old orchards grass is left on the ground; clean culture is practiced in young orchards; legumes and rye are used as cover crops, being turned under when green. San José scale is causing the most serious injury; fire blight has not appeared. Early strawberry blossoms were cut by frosts, and in near-by districts the loss was serious on general crops; prices have been satisfactory. Spraying for sooty fungus and other fruit diseases is practiced. On my own farm our small patch of strawberries was unusually fine; apples will be light.

Three Rivers (J. T. Geer). — Peaches and plums were wholly destroyed by frosts; apples, 50; cherries, 75; strawberries, 25; pears suffered no damage. Fruit crop prospect: apple, 50; pear, 100; cherry, 25; currant, 25; raspberry, 100; blackberry, 100. Usually grass is cut and removed from orchards; very little planting of legumes as cover crops is done. Tent caterpillars, codling moths and curculios are doing the most damage; fire blight has appeared in orchards. About 25 per cent of the strawberry crop was damaged by frost; prices from 15 to 20 cents per quart. Summer spraying for sooty fungus and other diseases is practiced. More orchards are being cultivated this year than ever before; people are finding out that it is impossible to raise good fruit without cultivating and thoroughly spraying their orchards. In some orchards the freeze was a great blessing, as it thinned the fruit just right.

Brimfield (E. S. Butterfield). — Frost damage to fruits is as follows: apples, slight, — 10 per cent; pears, 80; peaches, 80; plums, cherries and small fruits, some. Apples set well; peaches, pears and plums less than 10 per cent, except early peaches; there has been very little drop. Crop prospect: apple, 90; pear, 10; early peach, 25; late peach, 10; currant, 100; raspberry, 75; blackberry, 110; blueberry, 100. The common orchard practice is to keep them in sod, cutting and removing the grass; the best orchards are cultivated; legumes are used, but not very largely, rye and buckwheat being most in use. The codling moth and curculio are doing most damage; fire blight has not appeared, to my knowledge. The strawberry crop was injured by frost 50 per cent on low lands, 10 per cent on hills; there are very few raised commercially. The damage to fruit by the May frosts was uneven; on low ground in some places all blossoms were killed, while on hillsides, with good air drainage, scarcely any damage resulted.

Worcester County.

Lunenburg (H. O. Mead). — Frost damage to fruits was as follows: apples, 20; pears, 10; peaches, 30; plums, 40; cherries, 10; small fruits, 20 to 40. In favorable locations tree fruits set well; there has not been much drop as yet. Crop prospect:. apple, 50; pear, 85; peach, 40; plum, 40; cherry, 75; currant, 90; raspberry, 75; blackberry, 85. In a few orchards grass is cut and left on the ground; clean culture is practiced to a small extent; legumes are planted very little, rye to some extent, and buckwheat still more. The gypsy moth is doing most damage at present; I have seen no fire blight. The strawberry crop was injured 25 per cent by frost;

prices have been satisfactory, and a little higher than last year. Frost damage was confined largely to low lands, and very favorable locations suffered no loss from that cause.

North Dana (Horatio B. Eddy). — Apples and pears set well, and there was some drop on apples. Fruit crop prospect: apple, 50; pear, 75; cherry, 10; currant and raspberry, 100. Cultivation has not been practiced; sod grass mowed and removed; legumes are not planted. The codling moth is doing the most damage; fire blight has appeared to some extent on pears. The frost injury to strawberries was 90 per cent; prices have been satisfactory. Spraying for sooty fungus is not being practiced.

Warren (A. N. Tuttle). — Frosts injured peaches, plums and small fruits, but did not damage apples, pears or cherries. Tree fruits have set well; a large drop is now going on. Fruit crop prospects are: apple, 90 to 100; pear, 100; peach, 50; plum, 25 or less; cherry, 75; currant, raspberry and blueberry, very little damage. Where sod mulch is practiced the grass is left, but in most orchards the grass is taken off. Clean culture is practiced by the best growers; legumes are used to some extent, but in many instances the orchard is allowed to grow up to weeds. The curculio and codling moth are doing the most damage; we think that fire blight has appeared. The strawberry crop was injured badly by frosts, but prices have been very satisfactory, ranging about 18 cents per quart at wholesale, as against 15 cents in 1912. Summer spraying for sooty fungus and other diseases is practiced. It is difficult to estimate the crop prospect from the bloom, or what the fall may be, but it looks large on apples, especially, as there are enough left for a good crop; it is evidently a good year for fungus growths.

South Berlin (C. B. Maynard). — Peaches and strawberries suffered from frost in some localities. Tree fruits set fairly well and there has been very little drop. Fruit crop prospect: apple, light; pear, fair; peach, fair; cherry, fair; currant, raspberry and blackberry, good. The orchard practice usually is sod mulch, and the grass is usually cut and removed. Colonies of gypsy moths are most injurious. The strawberry crop was damaged 35 per cent by frost; prices have been satisfactory, better than last year. No summer spraying for sooty fungus is practiced.

Shrewsbury (Chas. R. Webb). — Fruits were damaged by frosts as follows: apples, 15; peaches, 20 to 25; small fruits, 10. Tree fruits set as follows: 40 to 60 per cent; there has been a 35 per cent drop. Fruit crop prospect: apple, fair; pear, good; peach, poor; plum, fair; cherry, currant, raspberry, blackberry and blueberry, good. Sod mulch is practiced in orchards, the grass being cut and removed in most cases; cover crops have not been used in this town; they are just coming to it. Tent caterpillars are doing the most damage; no fire blight has come to my notice. Strawberries were not injured greatly, as a heavy crop is being picked; prices have been satisfactory, about the same as last year. No summer spraying is done.

Hopedale (Henry L. Patrick). — Peaches suffered from frost, but other fruits were not damaged. Tree fruits did not set well, and there has been considerable drop. Fruit prospect: apple, poor; pear, average; peach, poor; cherry, currant and raspberry, good; blackberry, extra good. Orchards are usually neglected; legumes are used very little as cover crops. Tent caterpillar has done the most damage. The strawberry crop was injured very little by frost; prices higher than average. No summer spraying for fruit diseases. In this immediate vicinity the apple crop will be very light.

Middlesex County.

Townsend (A. A. Seaver). — Frost has damaged fruits as follows: apples, 50; pears, 90; peaches, 60; plums, 30; cherries, 95; small fruits, 25. Eighty per cent of tree fruits set well, and there has not been much drop. Crop prospect: apple, pear, cherry, currant and raspberry, good; blackberry, fine; peach, fair; plum and blueberry, poor. Most grass is cut and taken away; no legumes are used as cover crops. The gypsy moth is the most troublesome insect; no fire blight has appeared. The strawberry crop was injured to some extent by frost, but the prices have been satisfactory; as compared with 1912, they were good. No spraying is practiced for sooty fungus.

Littleton (John H. Hardy, Jr.). — Frost damaged fruits as follows: plums and cherries. 90; small fruits, 50; apples and pears suffered no injury. Fifty per cent of tree fruits set well, and there has been considerable drop. Fruit crop prospect: apple, 60; pear, 75; peach, 70; raspberry, 60; blackberry and blueberry, 90. Grass is usually cut and removed from orchards; clean culture is generally practiced; a little clover is planted as cover crop, but usually grass and weeds are permitted to come up. The gypsy moth is doing most damage; blight, to a small extent, has appeared on Baldwin trees. Strawberry crop was injured 50 per cent by frost: the prices were better than the average, being 20 per cent higher than in 1912. Spraying for sooty fungus is being practiced to a small extent. One quite serious case of fire blight occurred in a small orchard of Clapp pears, here in town.

South Lincoln (James E. Baker). — Small fruits suffered from frosts, but other fruits were not damaged. About 75 per cent of tree fruits have set well. Fruit crop prospect: apple, 50; pear, cherry, blackberry and blueberry, 75; currant, 25. Clean culture is practiced in about 50 per cent of the orchards, and legumes are planted in about the same amount, rye and vetch being used to some extent. San José scale and gypsy and brown-tail moths are doing the most damage. Frost injured about 50 per cent of the strawberry crop, but prices are about the same as one year ago. On May 10 the temperature was 23°; May 11, 32°; May 12, 29°; May 13, 35°; May 15, 31°.

Belmont (Richard Hittinger). — Small fruits suffered from frosts, but other fruits were not damaged. Tree fruits set well, and there has been much drop. Crop prospect: apple, light; pear and peach, heavy; plum and currant, light; cherry, fair. Clean culture is the method practiced. The currant borer is the most troublesome insect now, others having been killed by spraying; fire blight has not appeared. Ten per cent of the strawberry crop was injured by frost; prices have been satisfactory, and were a little lower than a year ago. Spraying for sooty fungus is being practiced.

Marlborough (F. Howard Brown). — No frost damage since last report. Tree fruits set well usually, and the drop was normal. Prospect good for all fruits except plums. In some cases grass is left as cut; in a few, it is hauled off; clean culture is being practiced more extensively than formerly; crimson clover, vetch, buckwheat and rye are being used as cover crops. The curculio is the most troublesome insect, and the gypsy moths are spreading; there has been no fire blight, but the scab and cedar rust are in evidence. The strawberry crop in this locality was not injured much by frost; prices have been above the average and were higher than last year. Personally, have finished fourth spraying, although summer spraying is not practiced much in this vicinity. If the dry weather continues, the yield is bound to be affected. In spite of dry season there seems to be an unusual amount of fungus about; no green aphis, but woolly aphis is in evidence.

Ashland (Clark W. Brown). — There has not been much drop. Fruit crop prospect: apple, small; pear, 75; cherry, 80; currant, 90; raspberry and blackberry, 100. The usual orchard practice is sod mulch, and the grass is generally removed. The ordinary apple worm is doing the most damage. Ten per cent of the strawberry crop was injured by frost; prices have been above the average, — 15 per cent above last year.

Hopkinton Springs (W. F. Wheeler). — Seventy-five per cent of small fruits suffered from frost, but other fruits were not damaged. A good average of tree fruits set well, and there was very little drop where spraying had been practiced. Fruit crop prospect: apple, 60; pear, 95; cherry, 95; raspberry, blackberry and blueberry, good. Grass is both removed and left on ground to some extent; in young orchards clean culture is practiced some; legumes are not much planted; rye and buckwheat are used as cover crops to some extent, and crimson clover is gaining favor. The tent caterpillars, where not destroyed, are most troublesome. Frost damaged 25 per cent of the strawberry crop; the prices have been satisfactory, and were slightly less than those of one year ago. Spraying, to a limited extent, is practiced for sooty fungus and other diseases. The exceedingly heavy rains early in the month did more or less damage to crops in general. More interest is being manifested in crimson clover as a cover crop, nitrogen gatherer and soil improver for orchards; also in its value as an early spring fodder and for the honey bee.

Essex County.

Salisbury (Henry C. Rich). — Frost damaged 75 per cent of plums; apples, pears and peaches, 50; cherries and small fruits, except strawberries. were not damaged. Sixty per cent of tree fruits set well, and there has been considerable drop. Fruit crop prospect: apple, pear and peach, light; currant, raspberry, blackberry and blueberry, good; cherry, fair; plum, poor. Grass is cut and removed from orchards; clean culture is practiced; no cover crops are used. The gypsy moth is doing the most damage; very little fire blight has appeared. Five per cent of the strawberry crop was injured by frost; prices have been satisfactory, being 1 cent higher per quart than in 1912. Summer spraying has not been practiced, but there is a possibility of its being done this season. Peach curl is more troublesome than usual. Unless we get immediate rains, fruit crops will suffer more than usual from drought, due to the insufficient precipitation during the early part of the season.

Methuen (M. F. Noyes). — There has been no noticeable frost damage to fruits. Tree fruits set well; drop has not been as much as usual in June. Fruit crop prospect: apple, good; pear, good; peach, fair; raspberry, good; blackberry, very good; blueberry, fair. Grass is cut and made into hay; legumes are not planted, and only ordinary grass, orchard grass and timothy hay are used as cover crops. The tent caterpillar and gypsy moth are the most troublesome insects; no fire blight has been noticed. The strawberry crop suffered no damage from frost; prices have been lower than usual, and dropped suddenly the first of this week. Peach crop of good quality; quantity less than usual. No plums, cherries or currants raised to any extent in this vicinity; blueberry crop started out well. but drought seemed to damage considerably.

North Andover (E. O. Reynolds). — Frost damaged fruits as follows: apples, 1; pears, none; peaches, 50; strawberries, 40. About 50 per cent of apple blossoms set, and there has been much drop. Crop prospect: apple and peach, poor; pear, plum, cherry and currant, good; blackberry and blueberry, very plentiful. Grass is removed from the ground in nearly all cases; clean culture is practiced by the new men; clover is seldom used as a cover crop, grass being used as a mulch. The most damage is being done by the gypsy moth and San José scale. Forty per cent of the strawberry crop was damaged by frost; in my opinion, the prices of strawberries have been satisfactory. Summer spraying for sooty fungus is not being practiced.

Newbury (Elbridge Noyes). — There has been no noticeable damage by frosts. The setting of tree fruits was very poor; there has been much drop. Crop prospect: apple and plum, poor; pear and cherry, fair; peach and currant, good. Clean culture is the general method practiced; legumes are planted to some extent. The gypsy and brown-tail moths are doing the most damage.

Norfolk County.

Medway (Monroe Morse). — Tree fruits have not set well; the peach drop has been very heavy. Apples and cherries promise a good crop; peaches, fair. Legumes are planted quite extensively; oats, barley and rye are also used as cover crops. Peaches failed to set, and the cold weather blighted the embryo fruits; the drop has been unusually large.

Westwood (Ingram I. Margeson). — Apples, pears, peaches, plums, sweet cherries and currants were damaged 25 per cent by frosts. Not more than one-quarter of the tree fruits, including peach, set well; the drop of peaches and cherries has been very heavy. Fruit crop prospect: apple, 25; pear, 25; peach, 100; plum, 75; cherry, 75; currant, 75; raspberry and blackberry, 75; blueberry, 100. Orchards do best under cultivation; sod mulch is practiced and grass is left around the trees, which is better than removal of hay; clean culture is the method used; legumes are not much planted; general truck crops used in young orchards; some buckwheat is also used. Tent caterpillar, gypsy and brown-tail moths and the San José scale are doing most damage; have not noticed any fire blight this summer. The strawberry crop was injured 50 per cent by frost; prices have been very satisfactory, probably 25 per cent better than 1912. No summer spraying for fruit diseases is practiced. Fruit generally looks well. Peaches are unusually large for this season of the year; currants are of good size, although there is not a great quantity on the bushes.

Bristol County.

South Easton (Wilmarth P. Howard). — Frost has damaged fruit as follows: peaches, 50; plums, 85; small fruits, 25; most of the damage was done during the last week of May. Tree fruits set well, about 50 per cent; there has been very little drop. Fruit crop prospect: apple, 50; pear, 75; peach, 50; plum, 20; cherry, 75; currants, 75; raspberry, 100; blackberry, 100; blueberry, 100. Both methods of sod mulch are practiced in this locality; no clean culture; clover and cow-peas are used as cover crops; buckwheat is also used somewhat. The brown-tail moth and tent caterpillar are very injurious; no fire blight has appeared. The strawberry crop was injured 25 per cent by frost; prices have been very satisfactory, one-third better than in 1912. Summer spraying for sooty fungus and other diseases is practiced. There is much enthusiasm in regard to apple culture; many trees set this year and many more are contemplating the setting out of orchards; holes dug by dynamite, and much other farming is done by dynamite in this section.

Plymouth County.

North Marshfield (H. E. Gardner). — There has been no frost damage to fruits this year. There was a 60 per cent set of tree fruits; considerable drop. Fruit prospect: apple, poor; pear, good; peach, plum and cherry, fair; currant, good; raspberry, good; blackberry, fair; blueberry, poor. The sod is removed from around the base of the trees and the soil is well worked; legumes are used as cover crops; sometimes strawberries are planted between the rows, but they do not do well, owing to lack of light. The prices of strawberries have been away above the average, — 10 per cent better than in 1912. Summer spraying is practiced with excellent effect. The main product of this town is strawberries; there are few orchards, and these are not run according to modern methods; we pride ourselves upon raising the best strawberries in New England.

Bridgewater (L. C. Stearns). — Frost damage: apples, 25; peaches, 10; plums, 50; cherries, 10; tree fruits set fairly well, about 75 per cent; some drop of peaches. Fruit prospect: apple, 80; pear, 70; peach, 100; plum, 90; cherry, 90; currant, 90; raspberry, 80; blackberry, 100; blueberry, 100. Very little cultivation of any kind in the orchards; legumes are seldom used as cover crops. Damage by tent caterpillar has been most in evidence; a small amount of fire blight has appeared. The strawberry crop was injured 10 per cent by frost; prices have been rather higher than usual. To my knowledge spraying is not being practiced for sooty fungus and other diseases. Fruits in this section, both large and small, are badly neglected as to spraying, feeding and mulching.

Barnstable County.

Truro (M. F. Corey). — Frosts damaged 50 per cent of the plum crop. Tree fruits did not set well, and there has been considerable drop. Fruit prospect: apple, light; pear, peach and plum, medium.

Clean culture is the method followed; legumes are not used as cover crops. The aphis is doing the most damage; to my knowledge there has been no fire blight. Strawberry crop was not injured by frost; prices have been satisfactory thus far; season not yet over. Summer spraying for sooty fungus is not practiced.

Dennis (FRANK E. HOWES). — Frosts damaged plums 50 per cent, but other fruits were not damaged. Seventy-five per cent of tree fruits set well; not much drop. Fruit crop prospect: apple, good; plum, poor; pear, peach, cherry and currant, good; raspberry, blackberry and blueberry, fair. Most of the orchards in this vicinity are in hen yards and are free from fowl stuff; legumes are not used as cover crops. Tent caterpillars and brown-tail moths are doing most damage; have not noticed any fire blight. Strawberry crop was not injured by frost; prices have been satisfactory, about the same as one year ago. Summer spraying for sooty fungus and other fruit diseases is not practiced. Orchards around here are small, — mostly for family use.

SUMMARY OF MARKET-GARDEN CROP CONDITIONS.

The following list of questions, returnable June 27, was sent out to market-garden crop correspondents: —

1. Asparagus. How does the crop compare with normal? With last year? Has there been any recent increase in the acreage?

2. String and shell beans. Has the usual acreage been planted (give reason for any change)? Did they germinate well (give per cent germination)?

3. Beets. How does the acreage compare with normal? With last year? What varieties were used for early planting? For late planting? What is the present prospect for the beet crop (give per cent)?

4. Cabbage. How does the number of early set compare with normal? With 1912? What is the prospect for the early crop (give per cent)? What varieties are most used for early crop? For late crop? How does the prospective acreage of the late crop compare with normal.

5. Carrots. Are early sown as forward as usual? What varieties are used for early crop? For late?

6. Cauliflower. Is this crop grown successfully in your locality? What varieties are most cultivated?

7. Celery. How does the acreage of the early crop compare with normal? With last year? Is there any indication of early celery running to seed? How does the prospective acreage of the late crop compare with normal? What varieties are used for early crops? For late crops?

8. Sweet corn. What is the acreage as compared with normal? What is present condition of the crop (give per cent)? What varieties have been planted?

9. Lettuce. How does the crop compare with normal? With 1912? How does the price compare with normal? With last year?

10. Onions. Compare acreage with normal. With 1912. Have usual quantity of sets been put out? What varieties of onions are used for main crop?

11. Peas. Give acreage as compared with normal. With 1912. What is present prospect as compared with normal? What are principal varieties planted? Give prices per bushel June 27.

12. Spinach. Compare acreage with normal. With 1912. Has there been an average crop? How does price compare with 1912?

13. Tomatoes. Compare acreage with normal. With 1912. What varieties are most in use? What is the present condition (compare with normal)?

14. Insects. Are cutworms doing much damage? Are other insect pests troubling market-garden crops seriously (give kind, crop and extent)?

15. Frosts. Have frosts done appreciable damage to tomatoes or other market-garden crops since May 26 (give dates and damage done)?

16. Irrigation. How many acres of market-garden land in your vicinity are irrigated? What crops is this practice applied to? What systems are in use? How often is water applied? How much is applied per acre at one application? What is approximate cost per crop per acre? Give approximately the earliest date of application which appears to be profitable. The latest.

Replies were received from 30 correspondents and from them the following summary has been compiled: —

The asparagus crop has been a fairly good one this year, the figures at hand indicating 87.5 per cent of normal. While many report the crop as about the same as last year, and a few as a trifle better, the greater number claim that it was not quite as good. This is doubtless due to the fact that the rainfall of the month of May, 1912, was especially heavy, while this year the weather during this month was cold and rather dry. Six reports from scattered localities claim an increase in acreage, but the majority report no change.

The acreage devoted to string and shell beans this year is just about the same as usual, possibly a slight increase. The germination of seed has been poor; early planted beans rotted in the ground, owing to the cold and wet; there has also been more or less loss from poor seed this year.

The acreage of beets is practically the same as last year and is about 93.9 per cent of normal. The varieties most in favor, according to the reports, are, in order, as follows: for early crop, Crosby's Egyptian, Edmand's, Early Blood Turnip, Eclipse, Early Model, Early Wonder, Woodruff's Egyptian and Detroit; for late crop, Detroit Dark Red, Edmand's, Crosby's Egyptian and Bastian's. Although a trifle late at the present time, the prospect for the crop is 80.3 per cent of normal.

The number of early set cabbage this year is not as large as usual, being 83.5 per cent of normal, and somewhat smaller than last year. The prospect for the early crop is 68 per cent as compared with normal, the crop having been quite severely injured by maggots and curtailed by cutworms. The varieties most used for the early crop are, in order, as follows: Jersey Wakefield, Charleston Wakefield, Henderson's Early Summer, All Head, Winnigstadt, Glory of Enkhuizen, Burpee, Copenhagen Early, Early Express and Early Holland; late crop, Danish Ball-Head, All-Season, Flat Dutch, Stone-Mason, Succession, Sure Head, Glory of Enkhuizen, Winnigstadt and Hollander. The prospective acreage of the late crop, compared with normal, is 95.

Early sown carrots are hardly as forward as usual, probably from five to ten days late. Varieties most in use for the early crop are, in order: Danvers Half-Long, Chantenay, Oxheart, Henderson's Coreless, Rubicon, Early Scarlet Horn, Nantes, Short Horn and French Forcing; for late crop, Danvers Half-Long, Danvers Intermediate, Bagley's Improved Danvers, Chantenay and Rubicon.

The majority of the replies indicated that cauliflower could be raised in the different localities, very successfully in some, but with varying success in others, while a few reported that it could not be grown. Early Snowball and Dwarf Erfurt are by far the most popular kinds, while Danish Giant, Algiers and Burpees' Dry Weather were mentioned.

The acreage of early celery is practically normal, the drought having curtailed it somewhat; the figures at hand show it to be 99.3 per cent of normal. Compared with last year the acreage is somewhat larger. There is very little indication of the crop running to seed as yet. The early varieties most used are Paris Golden, Boston Market and White Plume; the late varieties, Giant Pascal, Boston Market, Paris Golden, Winter Queen and Columbian.

The acreage of sweet corn compared with normal is 95; the condition of the crop is 83.8. The following varieties have been planted, those reported the greatest number of times being placed first: Golden Bantam, Cory, Crosby, Early Dawn, Potter's Excelsior or Squantum, Country Gentleman, Washington, Stowell's Evergreen, Quincy Market, Lackey, Kendall's Early Giant, Shoe-Peg, Sheffield and Cosmopolitan.

The lettuce crop compares quite favorably with normal, the estimate being 93.7; it is somewhat smaller than the 1912 crop. Prices are 95.9 per cent of normal, although in several instances they were reported normal or above; they seem to be a shade higher than in 1912 in most sections.

The onion acreage, compared with normal, is 88.4; it is evidently slightly less than last year, although many report it the same. About the usual number of sets were put out. The varieties most used are, in order, according to the reports: Yellow Danvers Globe, Red Wethersfield, Prizetaker, Southport and White Globe.

As compared with normal the acreage of peas is 101, showing a slight increase; compared with 1912 it is 104. The prospect for the entire crop is 85 as compared with normal. The most popular varieties, in order, are: Gradus, Alaska, Telephone, Champion, Nott's Excelsior, Thomas Laxton, Sutton's Excelsior, Bliss Abundance, Senator, American Wonder, Alderman, Early Morn and Admiral Dewey. Prices on June 27 ranged from 75 cents to $2.75 per bushel, according to location, the average price being $1.70.

A rather small number of those reporting gave information in regard to spinach, this indicating that it is not grown as extensively as many other market-garden crops. The acreage, however, was slightly above normal, being estimated at 108; compared with last year it was 111. The majority of replies indicate that the crop was about average or a trifle above. Prices in general ranged higher than last year, one man reporting 10 per cent higher; another reported for 1912 from 75 cents down to 25; for 1913, from $1 down to 40 cents.

In acreage the tomato crop is 109.9 per cent, almost 10 per cent above normal; as compared with last year it shows a still greater increase, being 112.1. The varieties most in use, in order, are: Stone, Earliana, Bonny Best, Chalk's Early Jewel, Champion and Livingston. The present condition of the crop is 90 per cent of normal, the growth of the plants having been checked by the cold weather earlier.

Cutworms have done a large amount of damage this season, although they are not as active now as they have been. Maggots seem to be especially injurious, necessitating the plowing under of the early cabbage crop in some instances; onions also have been heavy sufferers from the maggot. The Colorado potato beetle has been much in evidence and squash bugs are quite plenty. The asparagus beetle also has caused a good deal of trouble. The striped cucumber beetle, plant lice, rose bugs, cabbage worms and gypsy and brown-tail moths are also mentioned.

Frost damage since May 26 has been very light in most sections. Berkshire County and western Hampshire County experienced quite severe frosts on June 9, 10 and 16; tomatoes, beans, peppers and lettuce were badly injured, and potatoes cut back, but they recovered later. These frosts were largely confined to the valleys. In North Dana frosts on the 10th, 11th and 12th of June did considerable damage. In Marlborough, beans and tomatoes were injured during the first week of June. In the town of Bedford some damage to tomatoes and corn has been done.

With a larger number of returns some interesting and valuable figures in regard to the practice of irrigation might be secured. The practice already has many adherents and is rapidly being extended in many localities. The Skinner system is most in use, although water is applied by hose and in furrows to some extent. Water is applied as often as the crops demand it, and in some instances every night. From one-half an inch to two inches is applied at one time. There is a great range in the estimates as to cost per crop per cent, as they run from $3 to $60. The earliest date of application ranges from April 15 to July 1; the latest date from September 1 to October 1, and later for celery. All market-garden crops are subjected to this treatment, and strawberries and other small fruits in many instances.

NOTES OF MARKET-GARDEN CROP CORRESPONDENTS.

[Returned to us June 27.]

CHARLES E. BOOTH, *Belchertown* (*Hampshire County*). — The asparagus crop is 70 per cent of normal; 60 per cent of last year; no recent change in acreage. The usual acreage of string and shell beans planted; germination, string beans, 2 per cent; shell beans, 75. Acreage of beets is about the same as usual; Edmands Early used for both early and late planting; prospect for the beet crop, 90. For the early cabbage crop, Copenhagen Early is used; for late crop, Roundhead. Early sown carrots are as forward as usual; the kind most in use is Danvers. Cauliflower is grown with varying success; Burpee's Dry Weather is the variety most in use. Sweet corn acreage, 90 per cent of normal; condition of crop, 75; Yellow Bantam and Sheffield Cosmopolitan are the varieties used. Acreage of onions, 110 per cent as compared with normal; 90, as compared with 1912; Danvers Prize Taker and Red Wethersfield are varieties used. Tomato acreage is about normal; 100 per cent of 1912; Chalk's Early Jewel most in use; present condition of crop, 60. Cutworms are doing a good deal of damage; striped cucumber bugs on squashes, melons and cucumbers is also very destructive. On June 10 the thermometer dropped to 29°; this damaged tomatoes, peppers, potatoes and beans, but did not hurt corn; potatoes and tomatoes starting again. No irrigation in this vicinity.

H. W. GURNEY, *Cummington* (*Hampshire County*). — String bean germination good, — 100 per cent. Sweet corn, condition late. Cutworms are doing more damage than usual. Frost of June 9 ruined lowland gardens.

A. J. RANDALL, *Hadley* (*Hampshire County*). — Asparagus promises an average crop, and the crop is good as compared with last year; the acreage of asparagus has increased; we have 18 acres. The usual acreage of string and shell beans planted; germination, 80. Acreage of beets, 75; not as large as last year; Blood used for early planting; prospect for the crop, 60. Number of early set cabbage as compared with normal is 50; as compared with 1912, 50; prospect for the crop, 60; Danish used for late planting; as compared with normal the prospective acreage is 90. Early sown carrots are not as forward as usual; Short Horn used for early crop; Half long, for late. Cauliflower is grown successfully by only a few. The early celery crop acreage is less than normal; 70 per cent of 1912; there is not so much indication of early celery running to seed as last year; the prospective acreage of the late crop is 100. The acreage and condition of sweet corn is normal; Early Bantam variety planted. The lettuce crop is normal, both in price and condition, as compared with last year. As compared with normal, the acreage of onions is 90; as compared with 1912, 90; White Globe used for main crop. Acreage of peas is 60; as compared with normal, 80; Champion is the principal variety planted. Tomato acreage, 100; same as 1912; Earliana and Champion are most in use. Cutworms are doing damage on some lands. There has been no noticeable damage by frosts since May 26. No irrigation in this locality.

R. K. Clapp, *Westhampton* (*Hampshire County*). — Asparagus crop is 80 per cent of normal; 100 per cent of last year; very little increase in acreage. Usual acreage of string and shell beans planted; germination, 90. Number of early set cabbage, 60 per cent of normal, 50 per cent of last year; early crop prospect, 90; Jersey Wakefield most used for early crop; Danish, Surehead and Flat Dutch, for late; acreage, 95 per cent of normal. Sweet corn acreage, 100 per cent of normal; condition, 80; Golden Bantam and Country Gentleman varieties planted. Pea acreage, normal; 95 per cent of 1912; present prospect is good; principal varieties planted, Alaska, Senator. Tomato acreage, 105 as compared with normal and also as compared with 1912; Earliana and Chalk's Early Jewel varieties most used. Cutworms are doing some damage. No appreciable frost damage since May 26.

Myron L. Brown, *West Springfield* (*Hampden County*). — The asparagus crop is normal, the same as last year; no increase in acreage. Usual acreage of shell and string beans planted, both of which germinated well. Beet crop is normal, and compares favorably with last year; Eclipse, Crosby's Egyptian and Early Model used for early planting; crop prospect is 100. Number of early set cabbage is normal, less than last year; Jersey Wakefield most used for early crop; prospective acreage of late crop is normal. Early sown carrots are as forward as usual; Danvers Half Long used for both early and late crops. Cauliflower is not much grown in this vicinity. Early celery crop acreage is normal, same as last year; no indication of early celery running to seed; prospective late crop acreage, 100; Golden and White Plume used for early crop; Pascal and Winter Queen, for late. Sweet corn acreage, 100; condition, 100; Early Dawn, Howling Mob and Squantum planted. Notts is principal variety of peas planted; prices, $1 to $1.25 per bushel. Tomato acreage normal, same as last year; Earliana and Stone most in use. Cutworms are doing damage in small gardens; other insect pests are not giving serious trouble. Four acres of irrigated market-garden land just installed in this vicinity; Skinner system used.

JAMES E. HAMILTON, *Palmer* (*Hampden County*). — Asparagus crop fair, larger than last year; no recent increase in acreage. Usual acreage of beans has been planted; germination poor. Beet acreage, normal; Early Blood used for early crop; prospect for the crop poor, 40 per cent. Number of early cabbage set less than normal, also less than last year; prospect for the early crop is fair; prospective acreage normal. Early sown carrots are not as forward as usual; cattle feeders most used for early crop. Sweet corn, acreage, better than normal; present condition, 90; Evergreen and Golden Bantam have been planted. Lettuce crop fair; smaller than 1912; prices poor, but better than last year. Onion acreage smaller than normal, smaller than last year; usual quantity of sets have not been put out. Pea acreage smaller than normal, less than 1912; prospect for crop fair; Champion and Telephone principal varieties planted. Tomato acreage larger than normal, and larger than last year; early varieties most in use; present condition good. Cutworms are doing much damage; other insects are doing serious damage to rose buds in this section. No noticeable damage by frosts since May 26. No irrigation in this locality.

J. F. FREELAND, *Sutton* (*Worcester County*). — Asparagus is not grown in this vicinity for market. Usual acreage of beans planted, and they germinated well. Beet acreage normal, same as last year; Early Blood for early planting. The number of early set cabbage is below normal and less than 1912; early crop prospect, 75; Henderson's Early Summer, Charleston and Wakefield used for early crops; Danish and All Season for late; late crop prospective acreage normal. Carrots not grown here. Cauliflower is grown successfully here; Early Snowball variety most cultivated. Celery not grown here. Sweet corn acreage above normal; present condition, 80; Red Cory, Lackey, Kendall's Early Giant planted. Lettuce not grown for market here. Onions not grown. Pea acreage normal; present prospect, 90. Spinach not grown. Tomato acreage below normal; present condition normal. The potato beetle is more numerous than usual. No appreciable frost damage since May 26. All crops are backward.

H. W. BRIGHAM, *Concord* (*Middlesex County*). — The asparagus crop is 60 per cent of normal; no increase in acreage recently. Erfurt cauliflower is successfully grown in this locality. Not much celery raised here. Sweet corn, acreage normal, same as last year; Washington variety planted. No lettuce raised here, and only a few onions. Tomato acreage normal; Bonny Best and Stone being most used varieties. Cutworms are not doing much damage here, but asparagus bugs are very numerous. No noticeable frost damage since May 26. No irrigation.

EDWARD R. FARRAR, *Lincoln* (*Middlesex County*). — The asparagus crop is 90 per cent of normal, 95 per cent of 1912. Usual acreage of string and shell beans has been planted; germination, 80. The acreage of beets is normal; early crop prospect, 75; late crop, prospective acreage, 70. Early sown carrots are not quite as forward as usual. Sweet corn acreage normal; present condition of crop, 90. Pea acreage is normal, as also is the tomato acreage; present condition of tomato crop is 80. Cabbage root maggots and squash bugs are doing serious damage in this vicinity. No noticeable frost damage since May 26.

HENRY LYNDE, *Melrose* (*Middlesex County*). — The asparagus crop is 110 as compared with normal, same as last year; no recent increase in acreage. Normal acreage of string and shell beans planted; germination, 95. Acreage of beets, 100, compared with normal; Crosby's Egyptian, early; Edmands, late; tops are badly eaten; otherwise, condition is 100. Number of early set cabbage, 100; compared with 1912, 100; early crop was plowed up; early variety, Early Summer Winnigstadt; late variety, Danish Ball Head; prospective acreage of late crop, 80. No cauliflower raised here. Acreage of celery compared with normal, 100; with last year, 120; no indication of running to seed; acreage, late crop compared with normal, 120; variety, early crop, Paris Golden; late crop, Pascal. Acreage of sweet corn, compared with normal, 40; present condition, 80; Bantam has been planted. Lettuce crop normal; compared with 1912, 120; price, 125 compared with normal; with last year, 125. Acreage of peas normal, same as 1912; prospect, 125; principal variety, Gradus. Acreage of spinach normal, same as 1912; there has not been an average crop; prices, 80 per cent of 1912. Tomatoes, acreage, 100, same as 1912; varieties in use, Earliana, Autocrat, Stone; present condition, 80. Cutworms doing considerable damage; cabbage crop plowed up, owing to maggot; maggot on beet also bad. From 8 to 11 acres in this vicinity irrigated; general crops, except asparagus and rhubarb; Skinner system and hose; water applied when land gets dry; sowed beets two days ago and watered at once; latest date of application October 1; my land is sandy and will take a great deal of water; have never kept account.

Walter Barton, *Weston* (*Middlesex County*). — Asparagus crop, 85; compared with last year, 75; 5 per cent increase in acreage recently. Usual acreage of string and shell beans planted; germination, 60. Beet acreage, 90, same as last year; for early planting, Edmand's; crop prospect, 80. Number of early set cabbage, compared with normal, 60; compared with 1912, 85; prospect for early crop, 50; Early Wakefield used for early crop; prospective acreage of late crop, 75. Early sown carrots about normal; Danvers Half Long used for late crop. Cauliflower is grown; Dwarf Erfurt is the variety used. Acreage of early celery, 70; compared with last year, 60; no indication of running to seed; prospective acreage of late crop, 85. Sweet corn, acreage, 95; present condition, 90; Golden Bantam, Crosby and Cory have been planted. Lettuce crop, condition, 85; compared with 1912, 80; price compared with normal, 85; with last year, 75. Onion acreage, 60; compared with 1912, 60; usual quantity of sets have not been put out; Yellow Globe Danvers most in use. Acreage of peas, 80; compared with 1912, 75; prospect for crop, 90; varieties, Alaska and Gradus; price per bushel, $1.75. Acreage of spinach, 90, same as 1912; there has been an average crop; price same as 1912. Acreage of tomatoes, 95, against 90 for 1912; varieties in use, Stone and Earliana; condition, 90. Cutworms are doing much damage; squash bugs also very bad. No appreciable frost damage. Two acres in this vicinity irrigated; water applied to lettuce and beets; overhead piping system; twice a week. Seeds in general have not germinated well. Strawberry crop about 75.

Frank L. Gowen, *West Newbury* (*Essex County*). — Acreage of asparagus, 50; last year about 75; no recent increase. Usual acreage of beans planted; germination about 85. Acreage of beets, 90, same as 1912; Eclipse and Crosby's the varieties used; present prospect fair. No early set cabbages for sale at this time; Danish Ball Head used for late crop; prospective acreage of late crop normal; condition normal. Cauliflower is grown successfully; Dwarf Erfurt and Snowball are the varieties used. Acreage of celery, same as last year. Acreage of onions normal, and compares favorably with last year; Early Round Yellow Danvers used for main crop. Cutworms doing a great deal of damage, especially to cabbage and cauliflower; onion maggot, brown-tail and gypsy moths also very injurious. Only 1 acre in this section irrigated, this being strawberries. Water applied daily by gasoline engine. Crops do not seem to be growing as fast as usual on account of the drought. In some places seeds failed to germinate. Many onion beds are affected with smut.

H. E. West, *Seekonk* (*Bristol County*). — Asparagus, acreage, 90, less than last year; no recent increase. Acreage of beets compares favorably with normal and with last year; Crosby's Egyptian for early crop; Detroit Dark Red for late. Early set cabbage compares favorably with normal and with last year; prospect for crop, 75; Early Jersey Wakefield most largely used; for late crop, Danish Ball Head. Carrots about the same as usual in condition; Danvers Half Long most in use. Cauliflower is grown with fair success; variety Snowball. Acreage of early celery, 100, same as last year; no indication of running to seed; early crop Golden Self-Blanching; late crop Giant Pascal. Lettuce crop compares favorably with normal, and also with 1912 crop; price, 80 per cent of normal; 75 compared with last year. Acreage of onions less than last year; usual quantity of sets have not been put out; variety, Yellow Danvers Globe. Spinach acreage normal, although less than last year; there has not been an average crop; price, 75 per cent of 1912. Acreage of tomatoes somewhat above normal, 10 per cent larger than last year; variety most in use, Earliana; present condition not especially good. Cutworms doing considerable damage. No frost injury. Forty acres irrigated in this vicinity; all crops included; garden hose and Skinner system; cost per crop per acre, $50 to $60; earliest date of application, April 15.

W. E. Everson, *Hanover* (*Plymouth County*). — The asparagus crop is about average, a little better than last year; there has been no recent increase in the acreage. Usual acreage of string and shell beans has been planted; in some cases not more than 30 per cent germinated. Beet crop acreage compares favorably with normal and with last year; Early Wonder used for early planting; Detroit Dark Red for late; present prospect very poor; almost impossible to get the early varieties. Early set cabbage below normal in number, and less than last year; prospect for early crop not over 50 per cent; Charleston and Wakefield used for early planting; Danish Ball Head for late; prospective acreage below normal. Early sown carrots not as forward as usual; Henderson's and Coreless used for early crop; Danvers for late. No great amount of cauliflower is grown here, what there is being Snowball variety. Very little celery grown in this locality. Sweet corn acreage is about average, and very good compared with last year; Early Dawn and Golden Bantam varieties planted. The lettuce crop is average as compared with normal; about the same as last year; price is lower as compared with normal and also as compared with 1912. No great amount of onions planted. Usual acreage of peas planted, and the prospect is for an average crop; many varieties are planted. Sutton's Excelsior being a popular one; on June 27 peas were selling at $1.50 per bushel, having dropped from $2.25 since June 24. Tomato acreage above normal, and a larger setting than last year; Earliana, Bonny Best, Bountiful and Stone varieties used; present condition is not up to that of last year. Cutworms are doing serious damage. No great amount of frost damage since May 26. Crops as a whole are not as far advanced as usual, and cutworms did considerable damage to cucumbers, squash and lettuce.

John Daniel, *Marston's Mills* (*Barnstable County*). — Asparagus crop is 90 as compared with normal. No large amount of string beans raised; one man has 2 acres for dry beans; cannot say as to germination. No beets raised here. There is probably less than one-quarter acre of late cabbage within a 5-mile radius. Cauliflower could be successfully grown here, but none has been planted. Celery is not raised in this locality. Sweet corn acreage, 90 or over as compared with normal; 60 per cent represents present condition. Onions are not grown here. Cutworms are doing serious damage on new land, but as yet other insects are not troubling market-garden crops. No appreciable frost damage since May 26. Many of the crops raised here are for home use, and it is, therefore, difficult to give accurate information regarding them.

John E. Howland, *Tisbury* (*Dukes County*). — Asparagus crop is 90 as compared with normal and with last year; there has been no acreage increase this season. The usual acreage of string and shell beans has been planted; germination, 60, owing to cold and wet weather, which followed planting. Beet crop acreage compares favorably with normal and with last year. Very few cabbages grown here. Cauliflower is not grown here. Celery is raised only in a small way, Golden Self-Blanching being used for early crop; Boston Market for late. Sweet corn acreage, 20 per cent above normal; present condition, 75. Lettuce crop is ahead of normal; prices compare favorably with normal and with last year. Usual quantity of onions have been put out; Red and Yellow Danvers Globe and Wethersfield are most common varieties. As compared with normal and with last year, pea acreage is 25; present prospect, 90; price, $2 per bushel, wholesale. Acreage of spinach is normal and the same as last year; there has been an average crop, and the price is the same as in 1912. Tomato acreage is 25 per cent above normal, and the present condition is good. Cutworms are reported very plentiful, and the asparagus beetle did some damage where chickens were not allowed to run in the field. Since May 26 the frost damage has been very slight. Not more than 20 acres of land in this vicinity irrigated; practice applied to small market-garden truck; Skinner system in use; water is applied every three or four days at night, and is allowed to run 6 hours at each application.

SUMMARY OF CRANBERRY CROP CONDITIONS.

Blanks, returnable June 30, were sent to cranberry correspondents which contained the following questions: —

1. Have there been any damaging frosts since date of last report (May 28) (give dates, temperatures and per cent of blossoms killed)?

2. What was the bloom compared with normal?

3. Give crop prospect at present date, compared with normal.

4. What insects are doing most damage? (*a*) What fungous diseases are causing damage? (*b*) What percentage of the growers in your locality have sprayed their bogs this year?

5. Are the vines on new bogs doing well? (*a*) What per cent of vines set this spring took root and are now alive?

6. How does the water in the ditches compare with normal at this time? With last year?

7. Are the growers in your vicinity becoming interested in the value of bees as pollenizers of cranberry blossoms?

Replies were received from 33 correspondents, and from these replies the following summary has been compiled: —

More or less damage which was done before the date of the last report, May 26, but was not apparent at that time, has become evident during the past few weeks. Since that date the most injurious frosts occurred on the nights of June 9 and 10. No damage was done on bogs which could be flowed, because warnings were issued and growers were prepared. Probably about 75 per cent of the bogs are equipped for such emergencies, but the remaining 25 per cent, which are dry bogs, suffered an injury of from 15 to 20 per cent as a whole, more in some sections and less in others.

While the date of reporting was a trifle early to accurately estimate the bloom in some sections, it was in general far enough advanced so that comparisons could be made. The large majority of correspondents gave it as normal or above, and the average of all returns indicates a 106.3 per cent bloom.

The prospect for the crop is very good, some reporting it to be the best for several years. Others report that it is too early as yet to give definite figures. The figures submitted, however, place the estimate at 98.2 per cent of normal for the crop prospect at the present time. This of course is subject to modification from different causes at later dates.

Up to the time of reporting, the black-headed fireworm was reported in many instances as doing the most damage. A few reported the yellow-headed fireworm. Several reported that no damage has as yet been done by fungous diseases. According to the majority of reports it is as yet too early to judge what the damage will amount to. "Ringworm," "false bloom," blast and scald are spoken of as causing some loss. Several call attention to the fact that fungous diseases are not generally understood by the growers, and so are not receiving the careful attention which the situation demands. According to the figures at hand only about 27 per cent of the growers spray their bogs at the present time for either insects or fungous diseases. This is not as it should be, but the growers are fast coming to realize the need and value of this practice, and the number of those employing it is steadily increasing. Cost should not deter the grower, for the added return will much exceed this outlay; a man can well afford to feed his chickens gold dollars if they will return him diamonds.

While the acreage of new bog set this spring was not especially large, the new vines are doing especially well, not one report to the contrary being received. Of all vines set 93.8 per cent took root and are now alive, showing that weather conditions were very favorable.

The amount of water in the ditches is of course regulated according to conditions where such regulation is made possible by a reserve supply of water, and wherever possible such a supply is maintained. On dry bogs, however, the supply of water is very nearly normal, being estimated at

97.3 per cent; springs are low, however, and the supply is fast decreasing at this writing. Compared with last year the water supply is somewhat better in Plymouth and Bristol counties, but down further on the Cape, in Barnstable County, the rainfall seems to have been lighter, so that the supply is rather lower than a year ago.

Interest in the use of bees as pollenizers is, in general, gradually increasing. The president of the United Cape Cod Cranberry Company states that they are thoroughly convinced of the value of bees, and have organized a bee department with a superintendent in charge of it. Some report that the growers are becoming educated to the value of bees but still depend upon wild bees or those belonging to others. One correspondent recognizes the value of bees, but also calls attention to the fact that there are other agencies which aid pollenization. It is encouraging to note the increased interest in this phase of the industry.

NOTES OF CRANBERRY CROP CORRESPONDENTS.

[Returned to us June 30.]

VERNON RICE, *Hopkinton* (*Middlesex County*). — There have been no damaging frosts since last report. Bloom promises a two-thirds crop. No insects or diseases doing serious damage; no spraying practiced. Vines on new bogs doing well; 90 per cent of vines set this spring took root and are now alive. Water is plenty; more than last year. No interest is being taken in bees as pollenizers.

MARCUS L. URANN, *South Hanson* (*Plymouth County*). — On the morning of June 9 temperature dropped to 30°; frost warnings were issued and owners generally prepared; some damage to dry bogs. Bloom 120. Crop prospect at present date about normal. Blackhead fireworm doing most damage. Newly set bogs doing well; 100 per cent of vines took root and lived. Water in ditches about normal; 50 per cent more than last year. Very much interest in bees; we have started a bee department. Some bogs were considerably damaged by spring frosts; those that were not were exceptionally well bloomed, and from present indications will bring the crop up to about average. There are more fruit-worm millers than last year at this time; there are some true and false army worms in different sections of the Cape; spraying for these has been quite general.

EDWIN A. STEVENS, *Duxbury* (*Plymouth County*). — There have been no damaging frosts since May 28. As compared with normal the bloom is heavy. Crop prospect very fine at present date. Insects are not doing any damage at this date. If any, fungous diseases are light. Nearly all growers in this locality have sprayed this year. Vines on new bogs are doing well, and 99 per cent of those set this spring took root and are living. The amount of water in ditches depends on the course of owners. Growers are becoming interested in bees as pollenizers.

Seth C. C. Finney, *East Carver* (*Plymouth County*). — Temperature varied in different bogs, June 7 to 10, 28° to 35°; many bogs damaged but cannot give per cent killed. Bloom about 95 compared with normal, and the crop prospect at present date is very good. Blackhead fireworms are doing most damage. Do not know of any fungous disease damage at this date. About 5 per cent of growers sprayed their bogs. Vines on new bogs are doing well, and nearly all the vines set took root and are living. Water in ditches is 80 compared with normal; 75 per cent of last year. A few of the growers in this vicinity are interested in bees.

W. A. Tillson, *Carver* (*Plymouth County*). — On June 9 the temperature was 28° above in some places, but bogs were mostly protected by water, so damage is small, not more than 5 per cent. Bloom is 20 per cent above usual crop. Blackhead fireworms are doing most damage. Vines on new bogs are doing well. Water is normal, same as one year ago. Only three or four growers are interested in bees. Many growers here have pumping plants, and most of the bogs are protected from frost damage and worms by the use of water.

L. M. Rogers, *South Carver* (*Plymouth County*). — The thermometer registered 26° on the night of June 9, and 40 per cent of unprotected blossoms were killed; probably 75 per cent of the crop was protected. Bloom is probably 20 per cent above normal; prospect is very uncertain, but I should say it was above normal. Yellow and black head fireworms are doing most damage, and the disease commonly known as ringworm is also causing damage. Maybe 20 per cent of the total area will be sprayed; they are just beginning, so it is difficult to tell. New vines are doing very well, and 95 per cent of those set took root and are living. Water about normal because of June rains; last year heavy rains occurred in May, none in June. Growers are becoming interested in bees, but are uncertain as to their value. I have three hives; think there are other forces to pollenize crop without bees, but do not wish to take any risk. The frosted area may or may not have a fair crop, but this cannot be determined sometimes until close upon picking time. Crop will be late, and, if cold nights come early, will not mature. Rainfall May, 1912, 4.57 inches; May, 1913, 1.86; June, 1912, .34; June, 1913, 1.76.

Donald McFoslin, *South Carver (Plymouth County)*. — On June 9 we had a slight frost which killed a small per cent of the buds. As compared with normal the bloom is 133. Crop prospect at present date cannot be determined. Blackhead fireworms are doing most damage. There is practically no fungous disease damage. About 20 per cent of growers in this vicinity sprayed, most of them having flowed. Vines on new bogs are doing well, and practically all vines set took root and are now alive. Water compares favorably with normal and with last year. Some of the growers are interested in bees. I have been bothered on a small piece with the bud worm, which is about one inch long and looks like the cutworm.

J. D. Pierce, *West Wareham (Plymouth County)*. — The frost of June 9 killed 90 per cent of a 17-acre bog here. Bloom is normal, and the crop prospect is about normal. Fireworms are doing most damage. No damage by fungous diseases. Bogs were sprayed by 40 per cent of the growers here. Vines on new bogs are doing finely. Water in ditches is normal, same as last year. Not much interest is being taken in bees. Where the water was held on the bog until May 20, the new shoots are looking finely, but of course they are later than those where the water was taken off earlier.

James J. Walsh, *Wareham (Plymouth County)*. — The temperature on June 10 was 28° in some places; not more than 5 per cent of blossoms killed. Bloom good, and the crop prospect at the present time is good. Blackead fireworm doing most damage. Fungous diseases are not well understood by the growers. Five per cent of the growers have sprayed their bogs. Vines on new bogs are doing well, and 95 per cent of those set took root and are now living. In most cases the amount of water is optional with the growers; on dry bogs the supply is rather better than last year. Growers are becoming interested in bees as pollenizers.

W. E. Myrick, *Wareham (Plymouth County)*. — There have been a number of frosts, but no serious damage has been done. Bloom about normal. It is too early to estimate crop prospect. Blackhead fireworms are doing most serious damage; too early to note fungous disease damage. Most of the growers in this locality have sprayed their bogs. Vines on new bogs are doing well, and about 90 per cent of those set took root and are now alive. Supply of water is about normal, and most of the ditch water is controlled by reservoirs. Some interest is being manifested in bees here. Bogs throughout this district are looking very well and are about to blossom this week.

S. A. Besse, *Wareham (Plymouth County)*. — On the morning of June 10 mercury was 28°; not more than 2 per cent of blossoms were killed. Bloom somewhat above normal, as also is the crop prospect. Blackhead fireworms are doing most damage. A small percentage of the growers here sprayed their bogs. New vines are doing well, and 100 per cent of those set took root and are living. Ditch water about normal, and in dry bogs is more than last year. Interest is being shown here in bees.

ROBERT T. HANDY, *Bourne (Barnstable County)*. — On June 9 the temperature was between 27° and 28°, and killed 75 per cent of blossoms on unflowed bogs. Bloom normal. Crop prospect, 50 per cent. Fireworms are doing most damage. Fifty per cent of the bogs here were sprayed. Vines on new bogs are doing well. Ditches are full, but springs are low. Some interest is being manifested in bees. Bogs with new growth abundant, if not covered or partially covered with water they were badly damaged by frosts: otherwise, bogs are heavy with blossoms.

JOHN H. CROCKER, *Falmouth (Barnstable County)*. — On June 10 the thermometer registered 29° to 30°, and some bogs were badly damaged; others had water on them. Up to the present time bogs are blooming very well, about the same as last year. It is too early to estimate the crop. Fire and girdle worms are doing most damage. I do not know that any bogs have been sprayed. Vines on new bogs are doing well, and about 95 per cent of those set took root and are alive. In my opinion the water supply is a little less than last year. Bees are not much talked of here. Some bogs are blooming very well, while others are making vines and have few blooms. I find that the winterkilling was greater than was at first thought.

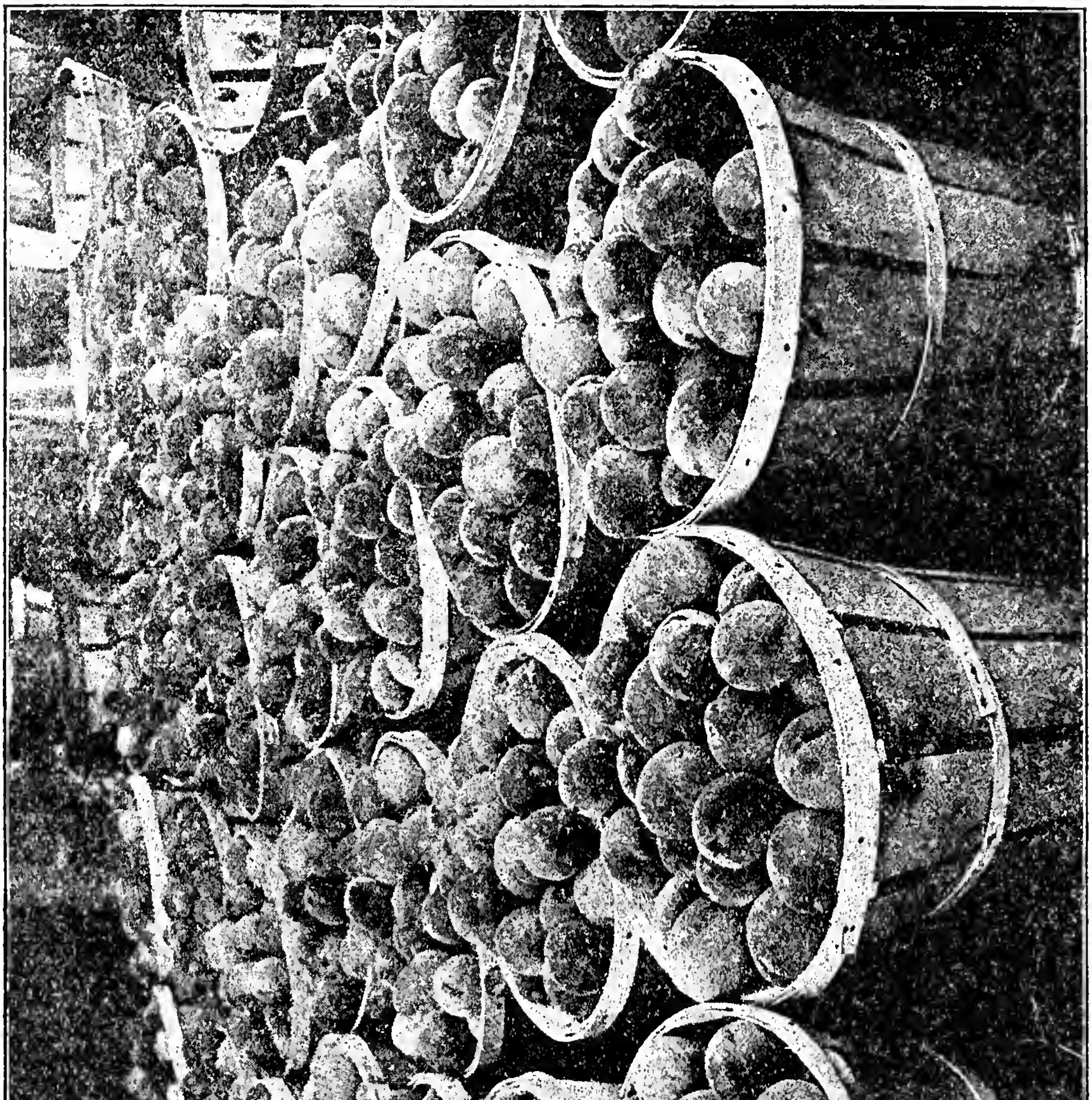
JOSEPH A. PETERS, *Mashpee (Barnstable County)*. — There have been some damaging frosts since May 28. Bloom is fair as compared with normal. Crop prospect is normal. Fireworms are doing most damage. At the present time there is no noticeable damage by fungous diseases. About one-tenth of the growers in this locality sprayed their bogs. Water supply is about the same as last year. Growers here are becoming interested in bees as pollenizers. I think the bogs in this section are looking as well as usual, if not better.

GEORGE T. MECARTA, *Barnstable (Barnstable County)*. — On June 9 the temperature was 37°, and at 1.30 A.M. June 10 it was 27°. Bloom, 100. Crop prospect, 100. Fireworm has been doing most damage. I do not know of any damage by fungous diseases. Spraying has been done by 20 per cent of the growers. Vines on new bogs are doing well, and 95 per cent of those planted took root and are living. Water in ditches is 80 per cent of normal, and is 80 as compared with last year. Interest is being manifested in the value of bees. The water in the ditches averages lower this year than last, as we are not having as much rain this season.

JOSHUA CROWELL, *Dennis (Barnstable County)*. — We have had several light frosts since May 28, but the damage was slight. Bloom is about normal, and the prospects are good for a full crop. Very few insects in evidence at present. Perhaps 10 per cent of the growers here have sprayed their bogs. Vines on new bogs are doing well. Water supply is about the same as last year. No interest is being shown as to the value of bees. Think it will be about a week before the vines will be in full bloom. Any predictions as to crop prospects at this time would be of little if any value. Most of the spraying will be done in the next two weeks, as it is about time for the second crop of fireworms, which are the most destructive.

F. D. Underwood, *Harwich* (*Barnstable County*). — There was a frost on June 9, but it is difficult to estimate the damage, which, however, was not severe; in low places it was probably 20 per cent. There was a 70 per cent bloom. Crop prospect, 75. Vine worms are doing the most damage. Cannot determine fungous disease damage until berries set. Only two growers have sprayed their bogs. Vines on new bogs are doing well; good season for vine growth. There is plenty of water, more than in 1912. No interest being taken in the value of bees. Spraying is being watched closely, and will probably be adopted here more generally another year.

H. S. Trueman, *Truro* (*Barnstable County*). — There have been no damaging frosts since May 28. The bloom was fully up to average, and the crop prospect is normal. Fireworms are doing most damage. No damage by fungous diseases. Vines on new bogs are doing well, and 85 per cent of those set took root and are now alive. Water supply is lower than normal, and is also lower than last year. Growers are becoming interested in the value of bees as pollenizers.



Massachusetts Peaches. — A Feast for the Eyes.

BULLETIN OF MASSACHUSETTS BOARD OF AGRICULTURE.

PEACH GROWING IN WESTERN MASSACHUSETTS.

Address by L. W. Rice of Wilbraham, at the Nineteenth Annual Meeting of the Massachusetts Fruit Growers' Association.

Establishing an Orchard.

Location. — First choose the site of the orchard. This should be a place of good elevation with good air and water drainage, which sometimes is hard to find and purchase. The land should be cleared of all trees and rocks. This can be accomplished best, and with least expense, by using dynamite. An orchard can be raised if the stumps and rocks are not all cleared away, but in the end the cost of clearing is saved in broken tools, loss of time and unpleasantness while spraying and cultivating. It is a pleasure to work in an orchard that has been well cleared, while one in which the stumps and rocks have been left is constantly trying one's patience. We want to carry on our business so that the work in the orchard will be a pleasure; and it is a pleasure to work in a good orchard. If the land contains any wet places they should be tile drained. The tile should be placed 3½ feet deep, so that the roots of the trees will not displace them; also, so as to drain the soil deep enough to give the roots plenty of room. The land should be thoroughly plowed. This is a slow, tedious job on rough land. It is best to plow the land in the fall, for then it will be finer and in better shape than if left until spring. If, however, one is unable to plow until spring, and it be a dry spring, harrow every morning what was plowed the day before. In this way the land holds the moisture.

Selecting the Trees. — Next comes the problem of selecting the trees. This should also be done the previous fall in order to obtain the desired varieties and grades of trees. In selecting varieties it is best to choose such as will ripen in succession, so as to hold the market and distribute the labor over as long a period as possible. A good succession covering the period from about August 1 to September 15 is as follows: Greensboro, Waddell, Carman, Hiley, Belle of Georgia and Elberta. Chairs Choice comes later than the

Elberta, but has been nearly a failure here. Don't plant it. A few years ago it would have been very desirable to get something later than the Elberta, but now so many peaches are put into cold storage and held until after the bulk of the crop is marketed that later ones do not bring as high prices as formerly. A No. 1, 4 to 5 foot yearling tree is a good grade for orchard planting.

Setting out the Trees.— If one is ready to plant the trees within a few days after they are received they may be left in the box. The box should be put into a shed or barn cellar and covered over with hay or straw to keep the trees from drying out. If not ready to plant the trees at once, open the box, loosen the bundles and cut the body of the tree off for about 20 inches above the bud, cutting off all limbs. Cut off the broken parts of the roots, also, and dig out the borers. The trees should then be placed in a trench deep enough so that they will be covered above where they are budded, taking pains to sift the dirt in around all the roots. Do not allow the roots to dry out. If possible the trench where the trees are to be placed should be in the lot where they are to be planted, as they are much handier and time is saved in carting. When it comes to setting out, it is well to have a barrel of water on a stone boat in the lot to wet the roots in. As to distance apart, the writer plants apple trees 32 by 40 feet, and plants two peach trees between one way, and one the other way, making the trees about 16 by 13 feet. This, no doubt, is too close for some localities, but here where the life of the peach tree is so short it is far enough apart. Dig the hole deep enough so there can be 2 or 3 inches of good top soil placed in the bottom. Then set the tree in the hole so that the place where it is budded will be a little below the level of the ground; sift the good soil in around and over the roots and tread firmly. Care should be taken not to injure the roots while treading. Put about a pound of bone or other good fertilizer into the hole and mix thoroughly with the soil. Next, fill the hole nearly full, leaving a little hollow with the tree in the center, so that when it rains the water will have a tendency to settle around the tree instead of running away from it.

Cultivation.— Cultivate and hoe the trees as you would care for a field of corn until the last of July or first of August. Sow oats and turnips or some other cover crop, such as vetch or clover, if you can grow it. If the land is steep, so that it is liable to wash, plow furrows along the side of the hill, beginning near the top and turning the furrow down hill to catch the water. Plow furrow so there will be fall enough to carry the water off. Plow similar furrows along the side of the hill as often as is necessary to take care of the water. These furrows should be plowed deep and cleaned out with a shovel; then scatter a little fertilizer in and on the furrow and sow oats rather thick and rake in. The oats will help keep the furrow from washing. When the trees get so large it is impossible in some places to plow the furrows along the side of the hill all the way, plow them so as to catch the water, and if need be plow straight down the hill to carry the water off. It is much better to have a few deep gullies washed that can be filled up with stone than to have a lot of the top soil washed off, as would probably be the case if the water was allowed to run down over the surface of the hill.

Trim the little trees in August, forming the head. Trim a peach tree just opposite to what you would if you were raising a tree for a saw log. A tree with from five to seven branches at the crotch will not be nearly so apt to split down as one with only two or three branches. If the tree is so shaped as to make it impossible to form a good head, tie up one of the best branches so it will grow up straight. Later, cut off all the rest of the tree and form the head out of that branch. Late in the fall, just before it freezes up, bank the trees with dirt 10 or 12 inches high. Be careful to pack the dirt firmly. If pieces of turf are thrown up loosely mice are apt to get in and nest and gnaw the trees. This banking not only protects the tree from mice but it keeps the water from running or standing around it. Then, again, if it is an unusually severe winter and kills the tender tree back, it will not usually kill it below the top of the mound. That leaves plenty of live wood between the bud and the top of the mound from which new limbs will start, and a new head can be formed from one of these.

The writer used to raise a crop of corn or potatoes in the orchard the first year and gives clean cultivation to all the land every year after until the last of July or first of August. Experience has taught that it is mighty hard in this locality to raise a cover crop, after the trees are three or four years old, that will add much humus to the soil. So now I am trying to raise some legumes the first few years to store up humus for the orchard later.

Pruning. — The second spring cut off one-half or two-thirds of the last year's growth. Along in August or the first of September thin out the branches where they are too thick. From this time until time of fruiting do not allow the branches to become too thick, for it is fruit that we are after. If the head is thick the fruit may set, but it will drop. After the trees come into bearing they need very little trimming, except to cut off broken limbs and cut out the dead wood, with a little thinning of the head occasionally.

Order of Season's Work.

Along in February we begin to trim the old trees, leaving the young ones until the last, as they are more apt to be killed back, and the longer we can leave them the plainer they show where they are killed. We pick up the brush on a wooden shod sled without any pole in it. This brings the load near the ground and takes very little room in turning. Just as soon as it does not freeze much during the night we begin to spray with lime-sulfur. In other words, we leave it just as long as possible and still get through before the leaves get started too much. We then plant what trees we have bought. This should be completed in April, but in favorable seasons if the work is not finished before the 10th or 12th of May the trees will grow all right. Make it a point, however, to get the trees planted just as early as possible.

Next comes the fertilizing of the older orchards and the harrowing. This may or may not be the first harrowing. Just as soon as the ground is dry enough we start the harrow, working one way one week and crossways the next. Let neither haying nor hoeing interfere with the harrowing, but keep at it every week from early spring until the last of July or first of August. When the fertilizing is done we dig the borers and hoe the young trees. In August and the first part of September we trim the young trees.

If we are blessed with a crop we begin to harvest it toward the last of July. Before harvesting begins we go through the orchard every five or six rows tying back the limbs and raking out the stone to make a road so as to get through with a one-horse wagon. This wagon should be so rigged as to carry 40 or 50 baskets. Two men can draw a great many more peaches in a day on a wagon of this kind than on one that will carry 15 or so. At this time of all times we want the work to count. The peaches are picked and set beside these roads. Later, the men go through and pick up the baskets and draw them to the packing shed, which is located in the orchard. Plan to keep all the work as near together as possible; then it is easier to look after, and if it is necessary to change part of the help from one kind of work to another, there is not so much lost time. For instance, if the packing shed is right in the orchard, and one wishes to load a wagon of 200 or 300 or more baskets in a hurry, he can call a gang of pickers and in a very few minutes the load is ready to go.

The peaches are picked by sight, not by touch, for the latter way takes too much time. Divide the pickers into gangs and put a foreman in charge of each gang. The size of the gangs depends upon the kind of men that make them up. If they are men of experience who will work anyway, then the foreman can take charge of 7 or 8, and pick himself. If, however, they are inexperienced pickers and are men who are in the habit of working under a boss, don't give the foreman more than 6 or 7, and tell him not to pick a peach himself. Don't try to economize by giving the foreman too many men; better hire another foreman. Being near our market we let the fruit ripen on the trees; therefore some of it gets the best of us and drops. The first thing every morning the men go through the orchard and pick up what have fallen. In this way they do not destroy them while working, and they are ready for the day's retail trade and the peddlers.

By going through the orchard in the winter and picking the dried or rotten peaches, and burning or burying them, and by going through the Greensboro just before they begin to get ripe and picking the rotten peaches, we have had very little trouble with peaches rotting on the trees. Let us go back for a few minutes to the trimming of the tree. We have made it a spreading tree, to allow the sun to get at the fruit to give it high color. Therefore, in order to save many of the trees from destruction, we are obliged to bolt many bad crotches and wire from one limb across to the opposite one. This can well be done by using about No. 108 screw eyes which are screwed into the wood. Wire across with about No. 12 wire. Many limbs can also be saved when carrying a heavy load by tying one limb to another with soft, strong string. Care should be taken when tying trees in this way not to tie too short, but to allow the limbs to bend well over before the string supports them. If they are tied too short it makes the bend in the limb too sharp, and it will break just above the string. After the crop is harvested these strings should be cut off to prevent them from injuring the trees. The fertilizer should be bought in the late fall or winter, so that it can be drawn during the slack season, and be on hand when needed. It is well to have a little nitrate of soda on hand; then if the trees are making a slow growth, and the fruit begins to drop too much, put on some, or if a tree here or there does not look quite thrifty doctor it with a little nitrogen. Do not put on too much at a time, but put it on two or three times if necessary.

After the peaches are unloaded at the sorting shed they are sorted by women. We insist that the fruit be handled with care both by pickers and sorters. One woman has charge over the other sorters. This woman also has charge of the retail trade. The peaches are sorted so that most of them are No. 1's or No. 2's. However, the very ripe ones and the specked ones are sorted out, also the very large ones, which are marked "extras." Make the peaches the same grade all through the basket. Toward the top, place the red side of the peach up and round the basket. A basket finished off this way is pleasing to the eye. After the peaches are sorted they are loaded on the wagon or wagons, according to the number of baskets on hand. One three-horse wagon carries 336 baskets. This wagon was built specially for hauling peaches. In the rush season it makes two trips a day, or rather in twenty-four hours, to Springfield wholesale houses, a distance of about 10 miles. It starts about 1 o'clock A.M., and returns about 9 or 10 o'clock.

The wagon is again loaded and another team goes with it, returning in the evening or night, according to the traveling. This time the wagon is loaded by lantern light, ready to start in the morning.

Now we have gotten the peaches to the wholesale houses, where they are sold on commission. Right here I want to say a word about the wholesale men. We read so much in the farm papers about the wholesale men, as if they were our enemies, trying to rob us, and so little about the help they are to us. How could we handle our crops without them? I consider the wholesale men my friends and helpers. If I did not have confidence in them I should want to go out of the fruit business to-day. I believe that there are just as upright, honest men in the wholesale business as there are in any other, raising peaches not excepted. Furnish them with the best of produce and they will be anxious for your patronage, and get the best prices that they can for you. Let us hope that occasionally, at least, the farm papers may have a word of praise for the wholesale men.

At harvesting time a man has a great deal to look after, and is very busy. The better his system the easier and better he can take care of his business. Having put a woman in charge of the sorters he can go into the sorting shed and look around. If he sees that the baskets are not full enough, or are too full, or that the sorting is not done right, he does not have to hunt up the one that made the mistake, but simply call the attention of the woman in charge to the error. She looks after it. If a customer comes and wishes to buy a few baskets of peaches he can just say, "The lady will wait on you." He can then go into the orchard and look around. If he finds that a tree has been skipped, that the peaches are being picked too green, or not close enough, or are being too roughly handled, or, again, if he wants a gang of men to go somewhere else to work, he simply has to tell the foreman, who looks out for the rest. In this way a man can handle an enormous amount of work. While men who have large gangs of men working all the year round have a system, we who have a large gang of men for only a few weeks are apt to handle them in a slipshod way.

Baskets. — Buy your baskets early, that is, just as soon as the winter is far enough advanced so that you are reasonably sure of a crop, so as to get the hauling out of the way and have the baskets on hand. Then, too, they are generally a little cheaper at this time than at harvest time. While harvesting keep close watch of your stock of baskets and the amount of peaches to be picked. If you see that you are going to run short order more just as soon as possible, for sometimes it is difficult to get baskets at this season. If you have not baskets enough to hold the crop, and cannot get them, then you must let the peaches rot on the ground, and you have had the expense, labor and anxiety all for nothing. Better carry over 1,000 baskets than be 100 short.

Deer Damage. — In some fields the trees, especially apple trees, are badly damaged by deer. The writer built a fence around an 11-acre field, using woven wire 55 inches high at the bottom, and put two barbed wires about a foot apart on top, making the fence about 6½ feet high, putting the posts a rod apart at a cost of 82 cents a rod, put up. One of our good assessors told one of the men, "We can assess him more for that field next year for putting that fence around it." That is the way we fruit men have to take it. The State protects the deer. We try to protect our trees from the deer, and the assessor comes along and gives us a whack for doing it.

Pheasants. — In our own locality it looks as though we were going to have, or rather already have a pest much worse than the deer and harder to fence, — the pheasant. In the spring of 1911 there were many buds eaten in the writer's orchard. He was satisfied in his own mind that it was pheasant's work, for they were often seen in the orchard, but never caught budding. However, one of my neighbors saw one budding in his orchard a few days ago. These birds are getting to be very numerous in this section. Twenty-two were seen in an open field a few weeks ago.

The writer has an orchard where there was about 550 peach trees set ten years ago; this spring there are less than 200 left. In another orchard of about 750 peach trees set seven years ago, this spring there are 360 left. Yellows are to blame for nearly all of these trees being pulled out. The best stump puller that ever came into this section is a four-horse team, combined weight about 6,000 pounds.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 28.

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CO-OPERATION.

By C. R. White.

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

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APPROVED BY

THE STATE BOARD OF PUBLICATION.

CO-OPERATION.[1]

BY C. R. WHITE, PRESIDENT NEW YORK STATE VEGETABLE GROWERS' ASSOCIATION, IONIA, N. Y.

Some Suggestions toward solving One of the Most Vital Problems of the Present-day Farmer.

At the present time, when there is so much discussion regarding co-operation, and when there is such an apparent need for a great advance along that line, as relief from labor stringency, and complex methods of distribution of the necessities of life, it is evident to all who have studied the question of co-operation from the practical standpoint that the greatest need of the time is to educate the public to a thorough understanding of what real co-operation is, and to impress upon the would-be co-operator the fact that to co-operate is more than to become a sort of half-hearted member of some association, with no real obligation on his part; and it is further important that a warning should be given so that the public may not become the victim of smooth-tongued promoters or over-zealous enthusiasts, who see great opportunities in co-operation, but who have not become familiar with the human equation involved, which can be worked out only by education of the individual co-operators, and is, therefore, a rather slow and tedious undertaking.

Viewing the possible ways in which co-operation can be of benefit, especially to the farmer, without relation to the difficulties of putting them into operation, the field is so vast and the apparent benefits so great that it is indeed disheartening when he realizes how slow must be the growth which will eventually plant thoroughly well-organized associations throughout our country, having a membership whose loyalty to their association will be second only to their loyalty to country.

Co-operative insurance has long since ceased to be but an experiment. Millions upon millions of dollars of fire insurance are carried throughout the country by such companies. Rates have been materially reduced, and adjustments are made upon merit and justice instead of by avaricious and technical methods.

The co-operative creamery in thousands of cases has been of great-

[1] Crop Report for July, 1913.

est benefit, and when intelligently organized and conducted has almost invariably been successful; and right here let me mention a possible combination which can be carried on to great advantage with the creamery plant, where the same management, same steam plant and many other factors beside would work very auspiciously together. This combination is the co-operative bakery and the co-operative laundry. Why should not the overworked country housewives, where the help question is so hard of solution, be relieved by up-to-date bakery and laundry methods which are enjoyed in the cities? There are thousands of plants of this kind in operation in Europe where such co-operation is enjoyed.

Co-operative marketing is of the greatest importance if the "high cost of living," the now ever-present cry of the city consumer, is to cease. And yet at the same time there are many instances where the products of the farm waste in the field. Great savings can be made by co-operation in the purchase of supplies, and this can be worked to the greatest advantage in connection with the selling association, the same plants answering for both. By the combination of the two the association will be enabled to hire a competent manager, upon which so largely depends the success of all our efforts at co-operation.

Many States have enacted laws with the object in view of aiding co-operative efforts. In New York State a law for the incorporation of co-operative associations which is especially adapted to such organizations was enacted. Another act passed by the same Legislature authorized the Commissioner of Agriculture to appoint a superintendent of co-operation, whose duty is to assist in organization work. Such appointment was made, and the work is being carried forward in conjunction with the farm bureau. The New York State Grange Co-operative Committee are drafting plans of organization, and an organizer is to be appointed whose duty will be to assist local granges in organizing for co-operative work. Very many elaborate plans are being presented for bringing the producer and the consumer into closer relation, some of which have a great deal of merit. However, a word of warning should be given, for these schemes offer great opportunity for shrewd promoters to get rich at the expense of the would-be co-operators. In other cases, where there is no backing by those experienced in handling farm produce, so many difficulties are sure to arise with which the uninitiated will not be able to cope that their failure is certain. The old adage, "Great oaks from little acorns grow," I believe to be a safe guide for the supporters of co-operation. Many small, well-organized associations, where the membership is in close touch with their organization and with each other, from which they can learn true co-operation, hold a close sympathetic relation with the individual members which is impossible with a large institution whose membership is widely scattered. But some one will say no small organization can stand the expense of doing business along lines which will bring greatest success. Very well. A large central organization can be formed, and in many cases has been formed, from the small organizations, each small organization becoming a stockholder in the central organization and each sending a delegate to the stockholders' meetings. This gives a strong central body made up of picked men from the many smaller bodies. Because of the large volume of business, such organizations are enabled to get the very best experts to handle it, and further, it is always sought by the very best houses. Their strength commands the respect of the transportation companies. It enables them to have representatives in the field both at the receiving point and at the point of delivery, thus assuring the proper handling of the business.

From the foregoing it is easy to see the latent possibilities of co-operation. Some of our weak-kneed brothers will say it is visionary. But this is not so. I have not mentioned a single thing which is not represented by a living, working, successful institution, ranging from the small co-operative store to the mammoth Rochdale system of England, which grew from an organization of nine weavers to its present huge proportions, and the eminently successful credit associations of Europe, which assist the farmers to finance the farms and the institutions connected directly therewith; and in America the great citrus and deciduous fruit associations of the west.

We Americans are strong individualists and it is hard for us to give up that individual independence which is so diametrically opposed to co-operation; but necessity is the father of many great advances, and it is gradually crowding us to the advance line. As it forced European countries to co-operate in order to feed the vast population from a small territory, as it forced the great fruit interests of the west to seek relief through a community of actions, so it will steadily but surely drive us all to an understanding of the great benefits which are to be derived from co-operative efforts. To be sure, as has been the case in the past when co-operation has become an accomplished fact, the road will be strewn with the wreckage of failure, but so is it also strewn with wreckage in all commercial undertakings, and because of the failures it behooves us and enables us to take advantage of the past, and so organize that the pitfalls which have caused disasters before shall be avoided.

When shall the work of organization be commenced? The answer is simple: when the condition exists in marketing, purchasing, in dairy work or fruit growing, or in any other line of effort which can be materially improved by the combined effort of the citizens of the community. How shall the work of organization be carried out? The organizers should first make themselves familiar with the particular line of co-operative work which it is proposed to accomplish. It is essential that every member join with a correct understanding of what is expected of him and of what he has the right to expect in return from the association. The initial work of organization is so important that it is hardly possible to lay too much stress upon it. Lay your foundation well. Be careful that there is a perfect understanding of conditions, requirements and probable results. Be careful of your membership. It is not difficult, when getting subscribers, to keep out those very objectionable classes who never agree, who always want to take advantage, are habitual fault finders, or are dishonest; and, further, under no circumstances allow any one to become a member whose natural interests are not in accord with the purposes of the organization or who has interests which might be antagonistic. No one who is seeking position for himself should be allowed to become a member; if he is worthy, hire him, but do not allow him a voice in the membership. It is not necessary to have a large number to start with. A well-selected, loyal membership, which will work together with a determination to succeed, is the most desirable, even though small. All organizations should be incorporated. The sale of stock should be primarily for the purpose of obtaining members, although sufficient capital must be raised to carry on the business. Stock should not be sold with the view of an investment; therefore, the dividends on stock should be limited to a very nominal rate. All stock should be redeemable by the association at par, and a provision to that effect should be printed on the certificate and become a by-law of the organization. This provision should be operative when stock is offered for transfer, thus guarding against the possibility of the stock being bought up for the purpose of control. Dividends other than the nominal dividends paid on the stock should be paid to the co-operators in proportion to the volume of business done by them with the association. Do not be stingy in hiring a manager, for while the cost may seem large it will pay in the long run to have a competent man.

When the association is finally ready to do business there are some rules which should be followed explicitly. Absolutely no favors should be shown; treat every one alike, rich or poor, black or white; otherwise sore spots are sure to be made which are hard to heal. The strictest honesty should be exacted from all; a contract should be made with the members of the association which should define clearly and concisely what each party is to do for the other, upon what terms the transactions between the association and the individual are to be carried out, the amount of business to be transacted as near as possible and a forfeiture for breach of contract. In handling the transactions between members all contracts should be made the same as if no relation existed between them in the way of membership, and such contracts should be carefully drawn so as not to conflict with the anti-trust laws or with the decisions of the courts in relation to the restraint of trade. These contracts are very essential in order that the management may know what to expect, and after expenses have been incurred for the handling of the business of a member he should either produce the business so the profits will reimburse the association, or be compelled to make such reimbursement personally unless conditions which are beyond his control shall arise to prevent. It is extremely important that nothing shall be entered into in the way of a contract which can in any way be construed as seeking to restrain trade.

Many institutions have failed because they have anticipated their profits, paying upon estimates which proved to be too large and thereby exhausting the treasury. The most successful co-operative institutions do business with their members upon the market prices the same as they would with non-members, and, in fact, often transact business for non-members. At stated intervals, or when the business of a certain kind is closed up, the net benefits to which the members are entitled are declared as a dividend in proportion to the amount of business transacted with the individual members. This system has many advantages which will become apparent but which space will not permit of explanation here.

In handling of produce a system of pooling and insurance should be inaugurated so that the possible loss which is sure to come and is expected by all business houses will be distributed over the entire business, thus making what might be a heavy loss to the individual member practically nothing when borne by the entire membership thus co-operating to stand losses as well as to make profits.

In marketing produce I cannot too strongly urge the introduction of the packing-house system, each taking his product to the packing house or packing houses, which should be conveniently located and provided with proper facilities, and where trained, impartial packers pack every one's products to standard grades. High standard of quality should always be established and should be maintained at all times as to quality of product as well as to pack. Trade-mark brands should be used, so that the goods may become recognized in the market. A reputation is the most valuable asset in trade.

In conclusion, let me urge upon all co-operators to study well the methods used by the successful co-operative institutions, to be extremely careful in the introduction of innovations, for what may seem to be sure of success when viewed from the standpoint of our every-day competitive trade may fail absolutely when applied to co-operative work.

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DIVERSIFIED FARM ACCOUNTING.

By L. A. Sloman.

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DIVERSIFIED FARM ACCOUNTING.[1]

BY L. A. SLOMAN OF AMESBURY, MASS.

PREFACE.

It isn't knowledge we lack, it is application.

Keeping accounts doesn't take time, it saves time, which is money. But keeping accounts without proper system means more books, more writing and unnecessary figures, and yet doesn't give clearly the showing made by each department.

It takes but a few seconds to make an entry now; disputes can't arise if it is done. It is a matter of habit only, soon becomes automatic, and keeps customers satisfied, which is the cheapest advertising.

Knowledge of losses avails you nothing without prompt application of the remedies. To judge the efficiency of the remedy you must have figures to show the results in different methods of handling each department.

Neatly printed billheads and letterheads, on good quality paper, are an incentive to make out bills and correspond. Your personality is conveyed by the quality of your stationery and neatness of the heading.

If you can't answer inquiries the day received, acknowledge them, stating when you will give the desired information.

Bills and statements should be sent out regularly, whether due or not.

Working capital means money on hand and in the bank. Confine your business to the working capital at your disposal.

Fix a credit limit at below one-half your working capital and keep the total owed you by all customers within that amount. So sure as you trust out an amount in excess of your ready money, percentage of profit will decrease. Failures often occur from just this reason.

Anticipate large future payments by installments set aside regularly from the time they were contracted.

Note the difference between elapsed time and actual time necessary

[1] Crop Report for August, 1913.

to do a certain piece of work. It is loss in dollars and cents. Farm labor can be and should be accomplished on schedule time.

Don't expect your help to beat the sun two hours in the morning and still be in the middle of their afternoon's work when it sets. Allow them regular, reasonable hours; proper, airy quarters; good, wholesome food and plenty of it; and fair wages to boot. Overlook any one of these and the others go for naught. You can't obtain and keep good help without them all.

Skilled help turns out most work with least fatigue.

The most successful men never hurry. They plan ahead.

Chores aren't boys' work. Scientific balanced ration feeding means cheaper and full capacity production, materially reducing costs.

Results depend no more on what you are doing than on the things you are not doing, or doing wrong.

The kind of farming and breed of stock you like best will pay you the largest profits. It is not necessary to practice the kind followed by the majority.

You don't have to go to Aroostook to raise potatoes, or west to raise beef or mutton. Proper crop rotation will produce the potatoes, and soil cropping the pastures will increase your milk, beef and mutton production.

New England farmers have the advantage of markets near by.

Statistics prove the trend of travel from the west and Canada to be towards and not from New England. Look well to your methods and opportunities as you are now located.

Convince yourself by proper accounting methods where your mistakes were; take a new lease on life and the Old Farm and you'll be surprised at the opportunities so long overlooked because they were near by.

In no other trade in this country to-day has the student the advantages of the farmer. Knowledge is yours for the asking, either of the department at Washington or state colleges and boards of agriculture.

It is vitally necessary that you have your name put on the mailing list. Address Division of Publications, Department of Agriculture, Washington, D. C. You then receive each month a list of pamphlets published, most of which are free, from which to select those applying to your needs. Write for it to-day.

Any man, however successful, who doesn't keep records and take account of stock frequently, can be shown where he is losing money. He may show a large yearly profit, but in some department, were records kept, a loss would be shown that was greatly reducing his legitimate profit.

Well-kept accounts showing knowledge of details of your business constitute one of the strongest arguments you can present to the banker when in need of more capital.

Small Farm Accounts.

Principles only can be discussed with intelligence as individual needs require different methods even for the same kind of business.

Enlist the assistance of the young folks. It will increase their interest. Interest generates ambition which spells success.

Weigh your milk. Count your eggs. Milk weights and egg yields kept on weekly or monthly sheets may eliminate unnecessary entries.

Avoid details. Let the accounting system grow with your business.

Necessary to use: a multi-column journal and card index, or indexed bill-board file.

Credit columns or pages are right-hand; debits left-hand.

The many columns of the journal serve the purpose of different books in keeping the business of departments separate, at the same time showing practically the profits or losses of any department at a glance. Debit column shows pay-outs, credit column, receipts.

Cards or bills in your file may be used exactly as a page in a ledger and accounts opened for departments the same as for customers. Columns most frequently used should be nearest the name columns, except that column to post from should come first of all.

Column footings are carried forward from page to page, and those of the credit side added together should always equal those of the debit side.

Accounts thus kept, by a double-entry system, provide for a check on errors and proof of cash.

Prove your cash daily by comparing the count of the money with the difference between footings of the cash columns.

It is preferable that your cash columns include check account at the bank, though you may have separate columns for it if desired.

All entries must first be made in the journal.

Every time you credit or charge anybody or anything you must charge or credit somebody or something to balance.

A person's capital or assets consists of their possessions, real and personal, cash on hand and in the bank, plus what is owed them, less what they owe.

Profit or loss for an exact period is the difference between the net assets at the start and close of the period.

Departments of which the credit side is larger than the debit side make the amount of profit shown by the difference.

Those where the debit side is the larger lose the difference.

Sales for a given period consist of the money received plus what is owed you (bills, not accounts), less what was owed you at the start.

Purchases: the cash paid out plus what you owe (bills, not accounts), less what you owed at the start.

Bills due or payable are memorandum transactions that have not before appeared in the journal, and are put in in a lump sum to balance up, and then reversed and taken out to start the next period.

Accounts due or payable have already been entered, and the balances will appear on your resource and liability sheet or trial balance when books are closed and balanced.

Cash, file, inventory, entry and profit and loss columns are necessary in the journal. Also date and narrow column for checking postings.

Others are optional, as poultry, pigs, sheep, produce, fruit, grain, tillage, expense, labor, household, stable, improvements and whatever others you need.

Bills receivable taken into consideration when you start your books should consist only of good, live customers you are sure will pay; slightly doubtful ones may be carried in a suspense account. Poor ones should not enter your books at all, though a record may be kept for reference.

Labor should be charged with your time, the time of the hands and their board.

Labor may be credited regularly and departments charged in proportion as time was spent. This provides a way of keeping the time charged up though the hands are paid irregularly.

Charge yourself regularly with a certain amount of money. Keep it in a separate pocket from your business money. This does not intend to cover household expenses, but saves charging up small amounts spent for personal use.

Household may be charged with fuel, cash paid out for groceries, and products exchanged for supplies or consumed.

Simplest way is to charge up time, seeds, fertilizer, manure, etc., used on house garden instead of produce as used.

Household should be credited with board for the hands and such labor as is performed in caring for poultry, milk or butter.

It is not at all superfluous to keep track of the meals consumed at your table. When the cost is computed at the end of the year your small bank account may be the result of too much entertaining.

Live as you like and entertain as much as you wish, but know just what you can afford.

Debit Side.

Improvement.	Dairy.	Pigs.	Sheep.	Poultry.	Produce.	File.	Ledger Accounts.	Cash received.	Date.	Ledger, Page or File.	
-	-	-	-	-	-	-	-	$550 76	Dec. 1	-	Cash and bank.
-	-	-	-	-	-	-	$1,000 00	-	-	3	Land and buildings.
-	-	-	-	-	-	-	40 00	-	-	11	Produce.
-	-	-	-	-	-	-	200 00	-	-	13	Poultry.
-	-	-	-	-	-	-	80 00	-	-	15	Sheep.
-	-	-	-	-	-	-	30 00	-	-	17	Pigs.
-	-	-	-	-	-	-	75 00	-	-	19	Dairy.
-	-	-	-	-	-	-	278 90	-	-	5	Utensils and implements.
-	-	-	-	-	-	-	10 00				Poultry,
-	-	-	-	-	-	-	3 70	-	-	1	Pigs, Capital.
-	-	-	-	-	-	-	25 00				Dairy,
-	-	-	-	-	-	-	83 60	-	-	-	Bills due you.
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	Reverse.
-	-	-	-	-	-	-	38 70	-	-	9	Bills owed.
-	$15 00	$10 00	$3 60	$20 00	$5 00	-	-	-	-	-	Produce.
-	-	-	-	-	-	$8 00	-	-	-	-	Geo. Jones.
-	-	25	-	-	-	-	-	-	-	-	Skim milk.
-	50	-	-	-	-	-	-	-	-	-	Cream.
-	-	-	-	-	-	-	6 25	-	-	23	Grain.
-	-	-	-	-	-	-	-	10 00	-	-	For old bill.
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	

Credit Side.

	Ledger, Page or File.	Cash paid out.	Ledger Accounts.	Produce.	File.	Poultry.	Sheep.	Pigs.	Dairy.	Stable.
Capital,	1		$2,254 66							
Bills owed,	9		38 70							
Produce, Poultry, Sheep, Capital, Pigs, Dairy,	1		5 00 20 00 3 60 10 00 45 00							
Entries,										
Poultry, etc.,						$10 00		$3 70	$25 00	
Bills due,	9		83 60							
1 can cream,									8 00	
Geo. Jones,					$0 25					
Stable,										$0 50
Eggs,		$0 25				6 00				
C. Murphy,								10 00		

Silage, hay and other roughage may be credited to tillage and charged to fodder account at market prices, less manurial value if to be fed.

Fodder account may be credited and stock charged as fed.

Stock should be credited with manure. Government pamphlet for values.

Manure account may be credited and charged where used.

Cement manure pits pay 50 per cent dividends. In other words. extra value in two years' manure pays for cost of construction.

Stable may be credited and other departments charged with work done.

Stock to be fattened may be handled as follows: credit dairy and charge live stock; credit sheep, charge mutton, etc., weighing if possible at time of transfer and charging feed and care to new department to ascertain cost of fattening.

Date and customers' name columns may appear on either right or left page of journal as debits or credits permit of space.

Improvements should be kept track of in order to give a clearer idea of the selling value as well as to show where the profits go.

Expenses should be charged regularly with such amounts for taxes, insurance and interest (on money invested, even if no mortgage) as will anticipate them in full when due.

If you can't show profits besides wages for yourself and interest on the money invested, poor crops and accidental loss of stock may wipe out your living expenses even.

Charge expense regularly with depreciation in such amounts as will cover average expectation of life of the stock, usefulness of equipment and repairs of the buildings. You have thus set aside before drawing profits a fund out of which stock and implements may be replaced and repairs made. It is like putting money in the bank.

Should you wish to draw profits from the business it is well to open a surplus account and a percentage of each period's profits may be charged to it. This provides you with a steady drawing account when bad crops and losses cut profits, even when losing.

Keep your personal drawings and expenses within earnings.

Whether or not you have a dollar in the bank, if instructions are followed as outlined, it is in the business and you haven't become your own worst customer. You don't allow the hands overdrafts.

File columns are to provide a close watch on total amount of money owed you at any time. Check over customers' accounts occasionally and see that total amount agrees with difference between footings of journal file columns.

Customers' charge entries may be made thus: credit amount of sale in proper department column of journal, write customer's name in name column, enter date (once for each day), and charge file column with amount of sale.

Head a bill for the customer (if a new one), post amount and put "F" in narrow column on debit side of journal. This shows you where to find account.

When payment is made on account, credit file column, enter customer's name and charge cash column. Post amount to bill and put "F" in narrow column on credit side, showing that credit has been given.

If payment is for full amount, bill may be destroyed or removed to dead index and returned to the live one when account is opened again.

Do not remove bills from file, except when paid in full, without leaving a memorandum thereon, though they may not be lost, as difference between file column footings is equal to total of all bills on file.

In Order to verify, close and balance Books.

List up the bills you owe (not accounts), enter lump through entry column credit side of journal, and post to resource and liabilities card. On debit side of journal charge subdivisions of this amount to departments as they owe.

Post difference of file column footings to resource and liabilities card.

Take an inventory of things susceptible to market fluctuations in value.

Inventory values should be purchase prices and not selling prices, else you are anticipating your profits and affecting next period's showing.

Post through entry column debit side to resource and liabilities card, and on credit side through department columns as they belong.

Expenses should be picked over and apportioned as they belong.

Credit inventory column and charge department columns with original inventory at start. Transfer differences in department column footings to profit and loss columns.

Post inventory, profit and loss column footings and cash and bank balance to resource and liabilities card.

All column footings now having been taken into consideration, your resource and liabilities card is now a complete statement showing condition of your business, and footings should balance. If not, look for errors in transferring amounts. If divisible by 9, without remainder, they are most likely transpositions of figures, such as posting 27 for 72, 35 for 53, or dollars for cents of same number.

To re-open a Set of Books.

Return balances of cash, bank, file, and profit and loss to their proper columns in the journal.

Reverse the bills payable and inventory (taken at the close of the period) entries.

These reverse entries are necessary in order to keep payments of this period's cash for department bills owed last month from affecting last or next period's showing.

They enable you to show exact business and profits without regard to whether you owe or are owed more or less than at the start.

Note that inventory column leaves your department columns showing only receipts and expenditures, or, practically, your profits or losses at any stage of the period without necessitating balancing your books except for verification.

Entry columns are provided that you may watch more closely the amount owed you by all customers (by the file columns) than if department entries were made through these columns.

Profit and loss columns are provided that you may not have to open accounts for each department.

Resource and liabilities card takes place of cards for all.

The principles being explained the application rests with you according to your requirements.

Summing up the principles you will probably note that many things enter into the cost of production that you may not have considered before. Does your selling price allow margin enough to cover them?

Price is easily obtained. It's quality that is hard to get.

Watch your quality and demand the price. The higher the quality the more trouble you will have in keeping up with your orders.

Time spent on accounts will pay you more money than any department of your farm. Only a few minutes a day are necessary. Let them go and you have to wait for your memory. A memory that you think is infallible may cause you most loss, both in money and trade.

A customer lost isn't replaced by a new one gained. The lost one has reasons which do not make good advertising copy.

You may keep accounts on the barn door and be successful, but keep them you must or your stable may eat up the profit made by the much-despised hens.

Large Farm Accounts.

Necessary to use: multi-column journal, small ledger and indexed bill-board file.

The accounts kept in the ledger on diversified farming are generally as follows: —

Capital.	Produce.
Personal.	Pasturage.
Bill account.	Taxes.
Inventory account.	Insurance.
Profit and loss.	Dairy.
Stable.	Sheep.
Utensils.	Pigs.
Implements.	Poultry.
Household.	Improvements.
Fodder.	Depreciations.
Tillage.	Manure.
Grain.	Wood lot.
Labor.	Land and buildings.

Instructions for small farm accounts apply except as noted below.

All entries must first be made in the journal.

Inventory, entry and profit and loss columns in journal are unnecessary and are covered by the ledger account columns.

File and file columns are now used only for short-time customers and customers with small accounts, larger and long-winded accounts being carried in the ledger.

Unnecessary to have columns on both sides for some departments, only on the side where you have frequent entries, entries on the other side being made through the ledger account columns to the department account in the ledger.

Entries made in the ledger account columns should be immediately posted to their account in the ledger. When posted put the ledger page in the narrow column for reference.

You may have milk, cream and butter columns in the journal and all go to the credit of dairy in the ledger.

You may have department accounts in the ledger without any journal columns for them if entries are infrequent.

Do not post from any columns except ledger accounts' columns to the ledger, and from none but file columns to the file, except at closing.

You will have no resource and liability account in the ledger, as it is subdivided into accounts for each department.

Closing and reopening entries are made through ledger accounts' columns to accounts in the ledger.

Closing and Balancing Books.

Take inventory. Subdivide expenses.

Take preliminary trial balance (consisting of credit balances in one column and debit balances in the other). This must take into consideration the footings of your journal columns, except ledger accounts' columns, as well as the ledger accounts. Footings of these columns should be equal.

Take into account bills payable and receivable.

Post footings of journal columns, except ledger accounts' columns, to the accounts in the ledger.

Make entries (through the journal) of balances of department accounts to profit and loss account.

Final trial balance will now prove your books and show your true standing.

Reopening Entries.

Bring file and cash accounts back to the journal.

Reverse inventory and bills payable and receivable entries.

Explanatory Entries. — Say land and buildings are worth $1,000; cash on hand and in bank, $550.76; bills receivable, $83.60; bills payable, $38.70; utensils and implements, $278.90. Inventory shows: cows, $75; hens, $200; pigs, $35; sheep, $80; and produce, $40.

Make entries as shown on accompanying pages. Capital account now shows your assets.

It is now necessary to reverse the bills payable entry so that when you pay out money in this period, for bills contracted in the previous one, your departments will have a credit to offset the charge against them of cash paid out for the last period's business.

Bills receivable entry is reversed that departments may have a charge against them to offset money received this period that was due to last period's business.

Individual stock or pen records should be kept in order to keep the departments up to their fullest capacity for business.

Entries in the usual course of business may be made as follows: —

George Jones buys a can of cream, $8; you bring back from him 3 cans of skim milk for the pigs, value, 25 cents. Stable is credited 50 cents for hauling the cream. You exchange a case of eggs, $6, for 4 bags of grain worth $6.25, and pay 25 cents cash to the miller. Charles Murphy pays $10 he owed for a pig sold previously to starting your accounts.

These explanations, by the changing of column or department headings, are of use for any and all kinds of business. They are not given with the intention of making you a bookkeeper. Stick to your last (as the cobbler says), call in clerical assistance. It will pay big.

It is very necessary, however, that you understand the principles of accounts if not the methods. You can't expect employees to do your thinking. If they were capable of it they wouldn't be employees long.

Make sure that everything that enters into the cost of production is taken into consideration. This must be personal knowledge.

Be unhampered by tradition. If you can't make a department pay after trying different methods drop it in favor of another.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

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FARM ICE HOUSES.

By Prof. B. S. Pickett.

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

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FARM ICE HOUSES.[1]

BY B. S. PICKETT, M.S., PROFESSOR OF POMOLOGY, UNIVERSITY OF ILLINOIS, URBANA, ILL.

Massachusetts farmers in general are so familiar with the advantages in the use of ice on the farm during the summer that it is almost superfluous to call their attention again to these advantages. The use of ice for the cooling and preservation of milk, cream and butter has, however, been so long considered the principal object of ice-storage on the farm that it may not be out of place to call attention to some of the other advantages of having a supply of this cheapest of nature's refrigerating agents on hand.

The use of ice for the cooling of small fruits, including strawberries, raspberries, gooseberries and currants, has scarcely become, as yet, a general practice, other than as a means of holding them for a day or so for home consumption. Experiments in California, Ontario and in Australia have, however, indicated a great advantage in the precooling of many kinds of fruit as a means of improving their carrying capacity, and there is little doubt that the use of ice for the immediate cooling of fruits as they come from the plantations will come more and more into general use, particularly in a State like Massachusetts, where small-fruit culture must become of ever greater and greater importance in the fruit-growing industries of the State. A few of the larger producers of orchard fruits may also find it advantageous to use ice for the precooling, or even for the storage, of large quantities of fruit during the packing season, though the New England climate at this time of the year is, on the whole, rather favorable for the preservation of the orchard fruits until such time as they can be placed in regular city cold storage.

A convenient supply of ice on the farm provides also a good means of preserving butter, eggs and meats during the hot weather. It enables the farmer to market his perishable products at more convenient times, and sometimes enables him to avoid overstocked markets. It is a boon in case of sickness, and it is hardly necessary to say that it is almost an essential to the housewife in good housekeeping.

[1] Crop Report for September, 1913.

The numerous streams, ponds and lakes of Massachusetts provide, with the help of the winter climate, a sufficient supply of ice for summer refrigeration on the farm at little more than the cost of the labor in harvesting the ice crop. With this readily available supply, and an appreciation of the advantages of storing sufficient for the summer's needs, the principal question in the minds of Massachusetts farmers will be in what manner to store the ice rather than whether or not storage is desirable. This article will, therefore, deal more directly with the types of storage houses than with theoretical considerations of the value of the ice during the summer season.

The earliest form of ice-storage in use was the cave or pit. Historical records show that both the Persians and the Romans made

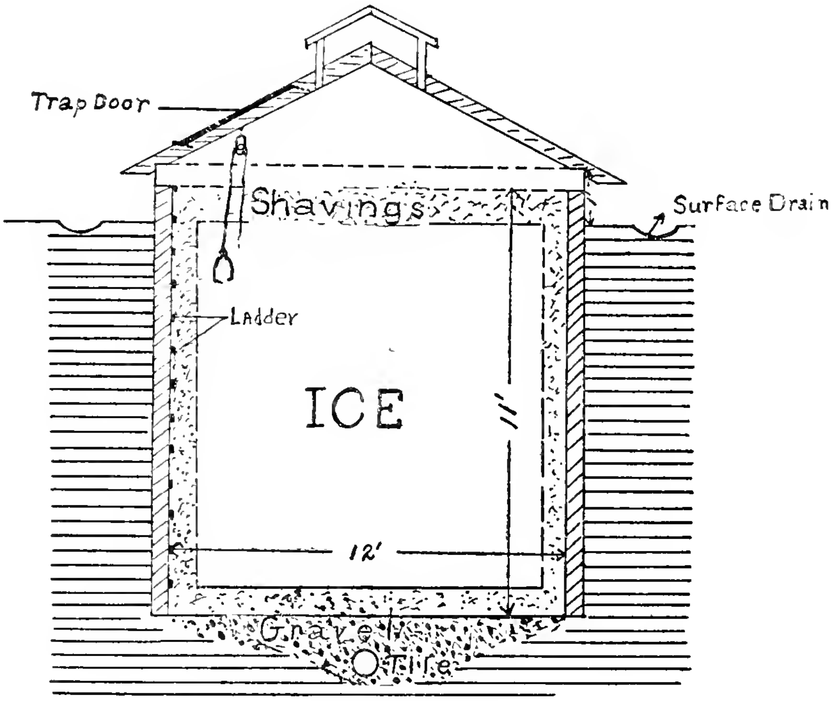

FIG. 1. — Ice pit.

use of ice brought from mountain caves to cool their beverages during the summer, and the practice of storing in such places has continued to the present time. Caves and pits have the advantage of protection from the direct rays of the sun, and of a comparatively steady temperature throughout the entire season. They have, however, the very serious disadvantages of poor drainage, inaccessibility and inconvenience in storing, removing or sometimes in both storing and removing, the ice. Fig. 1 illustrates a comparatively modern type of ice pit, showing how it is provided with artificial drainage and with insulation, with a roof as an additional protection against the loss of ice.

Of comparatively recent introduction, but of almost equal primitiveness in construction, is the use of the ice stack. This method of storing ice is extremely simple and may be explained in a few words.

In a shaded place on a gentle northern slope a rough floor of rails, rough boards or logs is laid as nearly flat as the materials used will permit. These floor materials should be laid parallel with the slope so that the spaces and irregularities between them will provide drainage down the slope. Over these rough boards should be placed 8 inches of sawdust or mill shavings, or 12 inches of wild hay. The ice is then stacked up as squarely as the blocks will permit, and to a height about equal to the rectangular dimensions of the pile if the quantity to be stored is small, or to as great a height as can conveniently be handled in case the quantity is very large. The nearer cubical the whole pile, up to a convenient height for handling, the less the loss from melting will be. The whole pile must then be covered with sawdust, shavings or wild hay, and the top protected by a cover which will turn the rain. Usually there is a sufficient supply of used lumber about a farm for this purpose, but a canvas cover can be used if desired. Fig. 2 shows one method of covering an ice

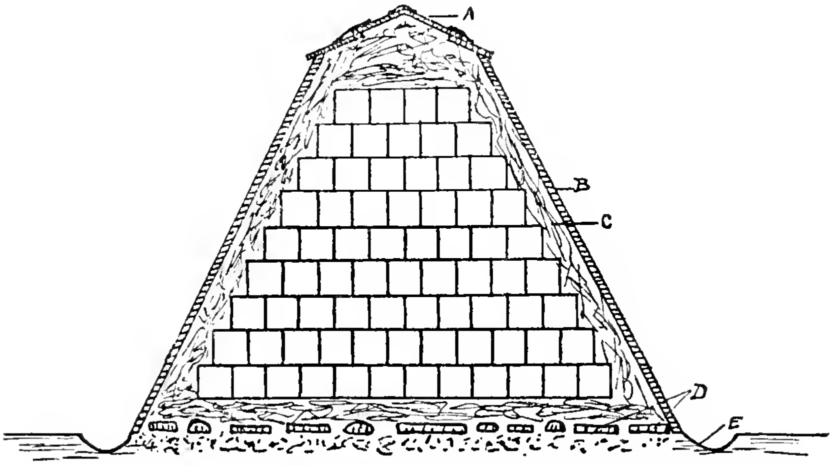

Fig. 2.—Ice stack. A, capboards held together by wire and staples; B, side boards standing on end and leaning against ice stack; C, wild hay; D, rough flooring; E, surface drain.

stack. Among the disadvantages in the use of the ice stack are the great waste in ice which must accompany the poor character of the insulation, and the difficulty of getting sufficient material to cover the entire stack. This latter difficulty is sometimes met by planting posts the height of the pile at its four corners at a distance of 8 to 10 inches from the corners of the stack, nailing on a few rough boards and confining the insulating material to the space between the boards and the ice. When this practice is followed, however, it will be seen that one is approaching the true building, or ice house, and it is practically a foregone conclusion that it would be much cheaper and more satisfactory in the long run to build a permanent rather than a temporary structure for the purpose. The ice stack is also likely to be inconvenient in location. A satisfactory place for it may not be available near the buildings. It is unsightly in appearance, and if located at some distance from the house and barns it will not give the service desired. The ice stack is, however, of value as a means of supplementing an inadequate home supply during the early part of the season. This is particularly likely to be true on large dairy farms where the ice house is not of sufficient capacity to carry a full summer supply. Under these conditions an ice stack built near the pond where the ice is gathered, or at some place convenient to the barns, may have its place of usefulness.

The third type of farm ice-storage may be termed the makeshift ice house. It consists in the appropriation, for the purpose of storing ice, of one end of the woodshed, a box stall in the stable, a corner in a leanto shed, the tool house or an abandoned chicken house. Occasionally such a makeshift ice-storage may be satisfactory and hold as much ice as is needed. The probabilities are, however, that it will not permit of adequate insulation, and that it will not carry sufficient ice to supply the farm needs through the summer. Not being constructed for the immediate purpose of storing ice it will not be adequately drained or ventilated, and if located in a conspicuous part of the farmyard it may prove to be a very unsightly part of the farm equipment. If ice is stored in a makeshift house care must be taken to see that there is no danger from fire as a result of spontaneous combustion in the insulating material.

Of storage houses there are many sizes, forms and methods of construction. The essentials of an ice house are: first, capacity large enough for its purpose; second, good insulation so as to prevent rapid loss of the ice through melting; third, drainage to carry away the water from the bottom of the pile of ice, as it melts; fourth, ventilation at the top of the ice pile; fifth, convenience of location; sixth, an appearance that does not detract from the general attractiveness of the farm buildings; seventh, reasonable cost.

The size of the ice house must be calculated in cubic feet of capacity, allowing 45 to 50 cubic feet of space for each ton of ice to be stored. A house 12 feet square and 11 feet high will hold approximately 25 tons of ice, — sufficient to supply a moderate-sized farm where the consumption of ice for milk cooling is not exceptionally large, — allowing space for the insulating material.

The most effective insulating materials available are dead air, wood and paper. Brick, stone, earth and concrete are fair conductors of heat, and are therefore not desirable for insulating purposes, though brick, stone and concrete may in some cases be desirable as outside walls, either for the sake of their superior lasting qualities or because they may correspond to the materials used in other buildings on the farm in question. Since wood is the only material available for construction among those named as desirable for insulation, it is recommended as the most generally satisfactory material for the construction of ice houses. Dead-air spaces may be formed by an extremely careful construction of walls, but this would be entirely impractical in a farm ice house, and if dead air is to be used as an insulating material it must be obtained by the use of sawdust and shavings, both of which materials are fairly available to Massachusetts farmers. When tightly packed between the ice and the walls of the storage house, shavings and sawdust enmesh in their crevices large quantities of air which is practically immovable in character, or dead, as storage-house constructors speak of it. Considerable air is also contained in the pores of the sawdust and shavings, and it is this immovable air, even more than the material itself, which makes of sawdust and shavings good insulating materials. Hay is less desirable than sawdust or shavings because the air enmeshed in it is not so finely divided, and may circulate to some extent. It takes a larger quantity of hay, and hence more space between the ice and the walls of the building, to give the same amount of protection with this material as with shavings or sawdust. For the most perfect result from the use of hay, sawdust and shavings the material must be dry, as any of these materials when wet are fairly good conductors of heat. For the best result at least 8 inches of well-packed sawdust or shavings should be used between the ice and the walls, and the top of the ice should be covered to a depth of 10 inches. If hay is used at least 12 inches should be allowed between the ice and the walls, and 14 or 15 inches on the surface of the ice.

Drainage is necessary because the water from the melting ice is a good conductor of heat, and if it accumulates in the bottom of the ice house and stands up about the lower tiers of ice it will cause a rapid loss. It will, moreover, soon soak the insulating material and thus permit rapid conduction of heat directly from the walls to the main stack of ice. It is also unsanitary, and will cause a rapid rotting of the timbers in the ice house.

Drainage is secured by the selection of a well-drained site, or by placing a tile beneath the ice house. Where the house must be constructed on a soil which does not drain well naturally, an excavation should be made the size of the house and 12 inches in depth. In the center of this excavation should be placed a row of tile leading to a satisfactory outlet, and the entire excavation filled in covering the tile with coarse gravel or cinders.

Ventilation should be arranged for over the top of the ice stack. Where the building is completely closed, the air above the ice beneath the roof becomes highly heated and causes a rapid loss by direct radiation of heat to the ice. Reliance for insulation is placed on the sawdust, shavings or hay which immediately covers the ice, rather than upon the main body of air above this insulated covering. By placing a ventilator in the ridge of the roof, and leaving a 6-inch opening below the plates all around the side of the building, a sufficient circulation of air will be secured.

The farm ice house should be located convenient to the buildings and in as inconspicuous a spot as can be selected. It is a common practice to locate the ice house close to the milk room for the sake of convenience in handling the ice. Occasionally the ice house is located near the pond where the ice is obtained, but unless this is immediately accessible to the buildings the farmer will fail to make

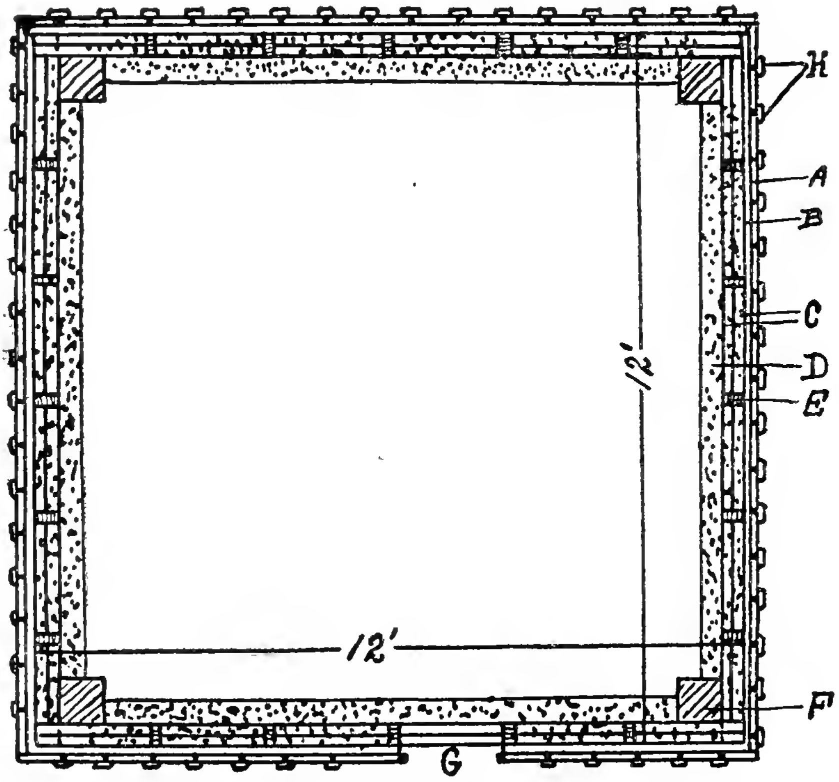

FIG. 3.—Well-built farm ice house plan. A, siding placed vertically; B, inside layer of boards placed horizontally; C, sills and plates made of two 2 by 4's spiked together; D, sawdust; E, 2 by 4 studs on 24 inch centers; F, posts about 7 by 7, 3 feet in ground and 11 feet above ground; G, opening for ice full height of house, and closed by boards placed in groove, constructed as shown in drawing; H, battens.

as much use out of the stored ice as he would if it were located within convenient reach.

The appearance of the ice house must be left to the judgment of the constructor. Nothing more can be said than to indicate that it should be in keeping with the other buildings on the farm. The ice house is for an extremely utilitarian purpose, and ornate ornamentation on a structure of this kind is uncalled for and usually entirely out of place.

Ice houses that will carry ice satisfactorily through the summer may be built at very small cost. The framework may well consist of roughhewn posts gathered from the farmer's wood lot. No floor is necessary. A double ribband of 2 by 4's securely spiked to the posts will provide both plates and sills. The studding should consist of 2 by 4's on 24-inch centers. The walls may be built of a single layer of rough boards nailed to the outside of the studding, or, if a better construction is desired, with better appearance, building

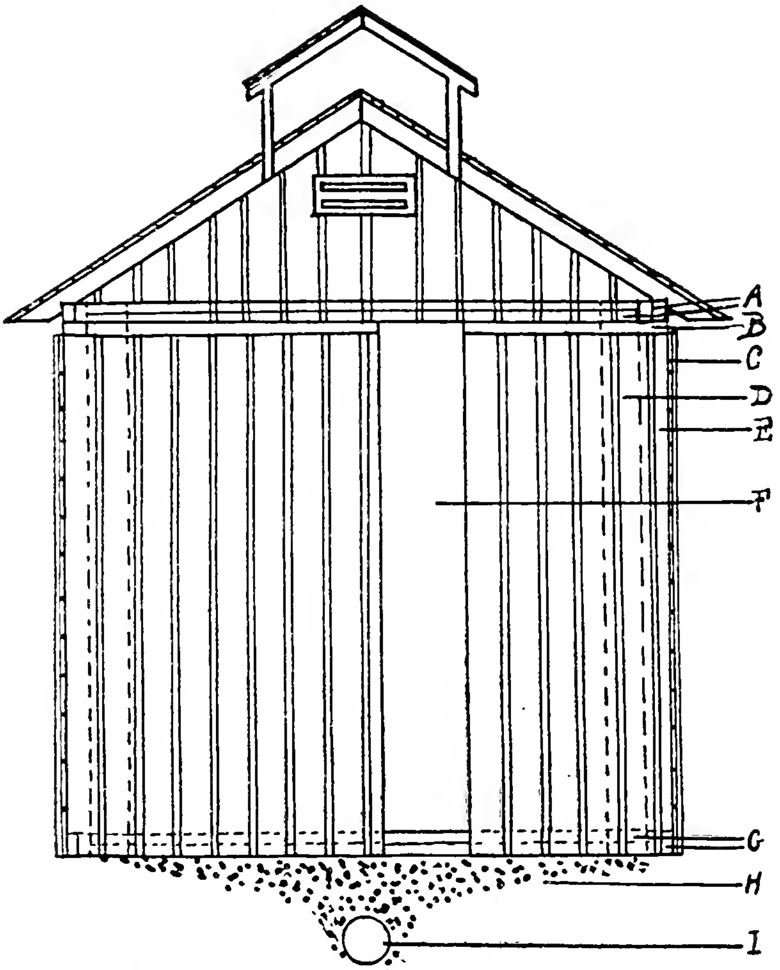

FIG. 4.—Well-built farm ice house. Elevation: A, plates; B, 6-inch open space between weather boarding and plates; C, weather boarding; D, posts (shown in dotted lines); E, studs; F, opening for ice; G, sills; H, gravel for drainage; I, tile.

paper may be used over this first layer of boards, and a second layer of boards, planed on one side and matched for size, may be nailed vertically over the first layer, this second layer to be battened with 1¼-inch battens, breaking all the joints. The latter type of construction, while much neater and more lasting, is but little more effective in the preservation of the ice, provided sufficient insulation is used between the walls and the ice itself, the outer wall being essentially only a protection against the wind and weather. The roof is essential to keep out the rain, and as a protection against the direct rays of the sun, and must be the best constructed part of the building. It may be of shingles, sheet metal or some ready prepared roofing, all of which materials are thoroughly satisfactory with the exception of those which are black. An ice-house roof should preferably be light in color in order to reflect the rays of the sun.

An ice house, holding 30 to 50 tons of ice, of solid construction, properly drained, and neat in appearance will cost from $50, where the farmer supplies considerable of his own material and labor, to $125, where all the materials are purchased and labor hired for the construction of the house.