MASSACHUSETTS

STATE DEPARTMENT OF AGRICULTURE

Circulars 1-25.

1918, 1919, 1920, 1921.

Circulars.

1. Back yard poultry keeping.
J. C. Graham.
2. Food, feeding and drinking appliances and nesting material to attract birds.
E. H. Forbush.
3. Report of the entomologist for 1918.
H. T. Fernald.
4. The English sparrow and some means of controlling it. E. H. Forbush.
5. Turkey raising. Margaret Mahaney.
6. Factors affecting hardiness in fruits.
U. P. Hedrick.
7. Fruit market possibilities in the export trade. A. W. Otis.
8. The efficient management of labor on the farm. F. C. Sears.
9. Control of the principal insects injurious to the apple above ground.
T. J. Headlee.
10. Bird houses and nesting boxes.
E. H. Forbush.
11. Orchard, berry, and vegetable fertilizers. H. J. Wheeler.
12. Outdoor bird study. E. H. Forbush.
13. Plants that attract and shelter birds and some that protect cultivated fruit.
E. H. Forbush.
15. Practical suggestions for raising turkeys. E. E. Tyzzer.
Marshal Fabyan.
16. Taking the risks out of farming.
E. S. Brigham.
17. The small agricultural fair.
O. E. Remey.
18. Raspberry and blackberry growing in Massachusetts. S. L. Davenport.
19. Marketing apples. D. T. Dodd.
20. Spraying. H. H. Whetzel.
21. Fruit growing for profit.
C. W. Mann.
22. Modern development in peach growing.
M. A. Blake.
23. Apple grading laws. B. D. Van Buren.
24. Winter injury to fruit trees.
W. H. Chandler.
25. The farmers' interest in game protection.
E. H. Forbush.

The Commonwealth of Massachusetts.

STATE DEPARTMENT OF AGRICULTURE.

WILFRID WHEELER, Commissioner.

DEPARTMENT CIRCULAR No. 1.

September, 1918.

BACK YARD POULTRY KEEPING.

J. C. GRAHAM.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1918.

Publication of this Document
approved by the
Supervisor of Administration.

9-18-10,000

BACK YARD POULTRY KEEPING.

J. C. GRAHAM, PROFESSOR OF POULTRY HUSBANDRY, MASSACHUSETTS AGRICULTURAL COLLEGE, AMHERST, MASSACHUSETTS.

Introduction.

"Necessity is the incentive to production" may be very well substituted, during this period of dire need for the necessities of life, for the old adage, "Necessity is the mother of invention." The large decrease in the number of poultry kept on farms in New England, and the going out of business of many of our commercial poultry keepers, will cause a material decrease in the amount of poultry and eggs produced in this section of the country, and at the same time greatly increase prices. Again, the prices of other meats — beef, lamb, pork and mutton — are still soaring, and have reached a point that almost precludes their use by people of moderate means. It seems, therefore, that if meat of any kind is to be within the reach of the great mass of people we must resort to poultry. It is well known to every household that eggs are a splendid substitute for meats, and that large numbers have been used from times immemorial during the spring or flush season of the year when the price was low in comparison with meats. If the consumption of red meats is almost prohibitive on account of high prices, and poultrymen and farmers cut down production of poultry and eggs, consumers will be obliged to become producers as well; therefore the necessity for the back yard flock on the part of those who have facilities to take up this work. People should not allow their vacation period to interfere with keeping a back yard flock, as arrangements can easily be made for their care during the absence of the owner. If the vacation is a long one the hens can be disposed of before leaving, or, if it is spent in the country, the hens can and should be sent there for economic production. Again, a neigh-

bor might be very glad to care for them for the eggs, or for a slight remuneration.

With the exception of the farm flock, back yard poultry keeping is considered by economists to be the most profitable source of eggs, due to the following reasons: —

1. The cost of feed is low on account of the utilization of waste, not only from the owner's table, but from that of neighbors; garden refuse of all kinds, together with lawn clippings, is usually fed abundantly.

2. The labor cost in back yard poultry keeping is low or nil; in fact, such work is considered by most people more of a recreation or health renewer than actual work.

3. Usually the flock is small and receives exceptional care, which results in an extremely high annual egg production.

4. Generally a splendid retail price is obtained for all surplus eggs.

5. The cost of house and equipment is low, and the land used is sometimes unproductive or not needed for crops.

There are a number of reasons why back yard flocks should be kept wherever possible: —

1. It reduces the high cost of living.

2. In homes where eggs are produced the tendency is to eat more eggs and less meat.

3. The poultry manure can be put to splendid use on the garden plot.

4. It saves labor in the disposal of refuse, or expense in having it carried away.

5. It increases the total amount of eggs produced, thus adding one's bit to the nation's food supply.

6. It keeps the boys and girls busy, and furnishes them with profitable labor.

7. It introduces the boy and girl to the commercial or business world.

8. In many instances it is the only way the wife or children can add to the family income or assist in production.

That from 90 to 97 per cent. of the people in Boston, for example, should be compelled to use only western or storage eggs is a lamentable condition, everything considered. In talking with a professional man of considerable prominence a

few weeks ago, he told me that he did not know the flavor of strictly fresh eggs until he had kept a back yard flock; that he had always supposed he was getting a fresh product, but evidently had been eating western or storage stuff; that, after becoming accustomed to near-by hennery eggs, he prefers to go without if he cannot obtain them. This instance is a good illustration of how readily the difference between fresh eggs and the western or storage products can be distinguished by the ordinary consumer when given an opportunity for comparison. There are thousands of people in the State who have never enjoyed the taste of a fresh egg. Again, the serving of invalids or very small children with eggs that are not strictly fresh may prove a serious matter.

Profit or Labor Income.

The profit or labor income from a back yard flock varies as much as that from any other line of work, and possibly more. The experience and capability of the owner, the construction and efficiency of the house and yard, the vigor and egg-producing qualities of the birds, amount of waste utilized, and method of care and management are all variable factors, and preclude a definite estimate that would serve as a reliable criterion. No doubt there are many back yard poultry keepers who do little more than break even, or may sustain a loss, but such cases are due primarily to lack of experience or interest, poor stock, inadequate equipment or poor management; in fact, we believe in most cases of this kind that the main factor is carelessness and neglect. Hens are not machines in the true sense of the word, but living beings, and need some attention. The following data have been sent us by successful back yard poultry keepers, and we are presenting these merely as samples of possibilities in this work, and caution the reader not to be discouraged if he falls far short of these results: —

A. On Sept. 23, 1916, purchased 12 pullets at $1.50 each, or $18; cost of feed, $28.60; produced 150⅔ dozen eggs, averaging 154.3 eggs per bird, valued at $69.67; 10 birds sold July 21, 1917, at 25 cents per pound, or $18.75 (2 birds died, 1 from disease, 1 from injury). Profit or labor income for ten months, $41.82, or $3.58 per bird, no allowance being made for the value of the poultry manure.

B. On Sept. 12, 1917, purchased 12 pullets, hatched in May, 1917, averaging 3 pounds 7½ ounces each, at $1.25 per bird, or $15. Cost of feed for eight months or until May 12, 1918, $42.30; began laying in December, and on May 12 had laid 1,133 eggs, or 94.4 eggs each, valued at $71.46. On May 12 the hens averaged 7 pounds 5⅓ ounces each in weight, valued at $26.40, market price. Profit or labor income for the eight months, $40.56, or $3.38 each. A splendid record, considering the date of hatch and time the birds began laying.

C. Poultry account for 1917: Fowls on hand Jan. 1, 1917, 31; increase in flock, 3; eggs laid in 1917, 3,912, value $167.65; fowls killed for table, $18.85; sold 6 Leghorn hens, $9; 3 pullets, $6; poultry manure, $9.30; total income, $210.80; expenses, $104.46; profit or labor income, $106.34; profit per hen, $3.43.

D. Poultry account for 1917: Equipment, 1 house 8 by 25 feet; 1 house 10 by 20 feet; also 3 colony coops 3 by 6 feet. Used about 1,600 square feet of land for permanent yard, and at times part of garden. Cost of grain, $319.28; sundries, $12.36; total, $331.64. Income: 19 fowls for home use, $23.81; fowls and broilers sold, $96.17; dressing, $3; eggs sold and for home use, $409.82; total, $532.80, leaving profit or labor income of $201.16, besides dressing and litter from hen house for garden.

E. I bought 100 eggs of —— in April, 1916; had them incubated, and got 60 chicks on May 3. These chicks stood me 21 cents apiece the day they were hatched; that paid for the eggs and incubating. From the chicks I raised 21 pullets that started laying Oct. 30, 1916. Following is the monthly production: November, 34; December, 287; January, 420; February, 349; March, 395; April, 428; May, 443; June, 365; July, 344; August, 220; September, 283; October, 117; total, 3,685. Total for each of the pullets for the year, 175, and I received from the sale of these eggs, broilers, cockerels, culled pullets, hens I sold for poultry, $199.69. I kept 9 hens to breed from which I valued at $18, making my total receipts from the 100 eggs $217.69. The total cost for all their feed of every kind for the year, cost of the eggs (the original 100) and incubation was $108.81, which left a balance of $108.88. As you see, I have made no reckoning of labor in the cost, for my wife did most of it, that is, the feeding; all the building and heavy work I did in spare time. During the year we paid as high as $4.40 per bag for corn, $1.85 per bag of oats, and all the other grains in proportion. We sold our eggs from 30 to 65 cents per dozen; guess it would average somewhere around 50 cents per dozen.

Back yard poultry house, 6 by 6 feet, of moderate cost, for 6 to 8 hens.

Model poultry house, 8 by 10 feet, designed for locations where appearance must be considered.

Three Years with Small Back Yard Flock (Pre-war Conditions).

Number of Females.	Year.	Eggs.	Eggs per Hen.	Value of Eggs and Poultry Sold.	Cost.	Profit.	Profit per Hen.
25, ...	1912	4,303	172	$234 25	$115 72	$118 53	$4 03
23, ...	1913	3,996	173¾	194 36	87 00	107 36	4 29
20, ...	1914	4,159	208	165 27	85 07	80 20	4 01

Equipment.

The House.

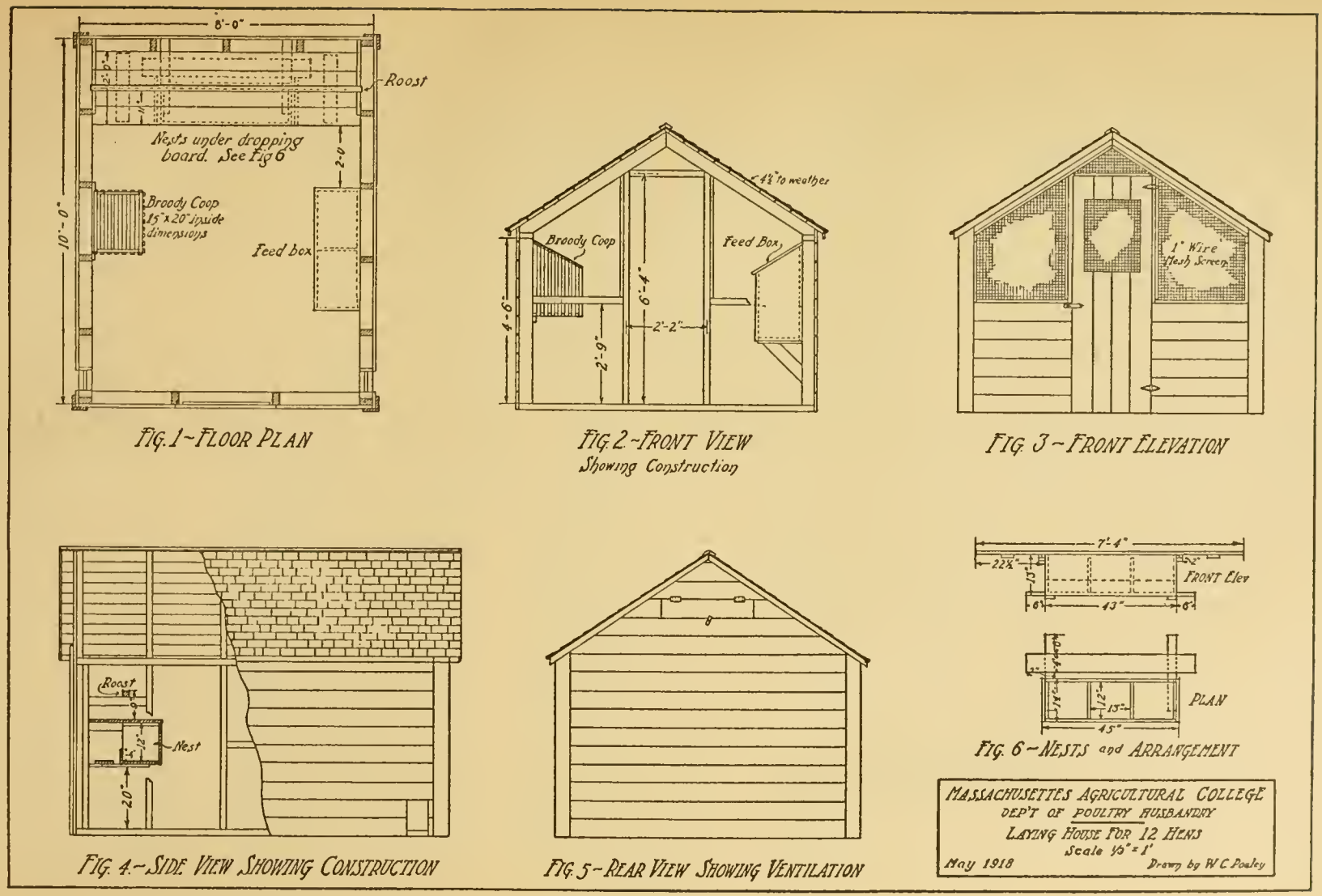
The poultry house should be located on a well-drained plot. If necessary, fill in or grade so the ground will slope away from the house. This will throw the drainage water from the yard on the garden plot, enrich the soil and at the same time have a cleansing effect on the yard itself. Convenience for the attendant should not be forgotten, as the hens must be cared for every day, and the garden plot is used only a portion of the year. The attendant should, therefore, have a direct route from the dwelling to the hen coop, and not be compelled to take a circuitous route to avoid flower beds or other small plots. Economy of space and utilization of the ground adjacent to the fence should also be kept in mind. If the land is dry and well drained, no floor is needed unless a movable house is desired, in which case a floor is necessary to keep the house in shape while transferring it. A wood floor can be made by using 2 by 4's on edge for joists, covering them with matched stuff; or a more durable floor can be made by removing the loam where the house is to rest, filling in with cinders or gravel for good drainage, and on this place a cement slab 4 or 5 inches thick. A floor built in this way is not expensive, and will be found very satisfactory.

A small poultry house should have at least 5 square feet of floor space per hen; should be well lighted, dry, well ventilated, convenient, inexpensive and sightly. Warmth should be considered, but not at the expense of dampness and poor ventilation.

The small poultry house illustrated is very sightly and well built. It may be considered expensive by some, but cannot be built for less money during present abnormal conditions. It is designed particularly for the well-to-do suburbanite, whose poultry house must conform with the other buildings on his place or meet the requirements of his neighbors; in fact, it is just the house to give tone to poultry keeping in residential districts where appearance must be considered.

The plan here presented fulfills the requirements of a good house. The double pitched roof with sides 4½ feet high gives plenty of head room, which is needed in a back yard house because the owner in most cases is a professional or business man who wears clothes that show dust and dirt readily. No casings are necessary. The door should project over the outside of each stud 1 inch, said stud performing the office of a stop as well as a support. The openings in the upper portion of the door and above it should be covered with inch mesh wire, but no cloth screens are necessary. In extremely cold weather white cloth can be tacked over these openings, removing same in mild weather. Inch mesh wire should be tacked over the openings each side of the door and cloth screens made for winter use. During the spring, summer and fall they should be fastened to the ceiling of the house or stored safely somewhere. When cold weather sets in the comfort of the hens can be somewhat increased by laying two or three boards or poles across the plates over the roosting quarters and throwing over these straw, cornstalks or other waste material. It will take very little time to do this, but it will lessen drafts and keep the hens warmer. This is especially recommended for Leghorns. Novelty siding is recommended for sides and ends, as it sheds water better than common matched stuff, and is neat and dressy in appearance. Matched boards are recommended for the roof, as they keep the wind from getting through and blowing off or cracking the roofing. A good grade of commercial roofing should be used.

The illustration facing page 7 is a shed-roofed house to accommodate six to eight birds. It is the plainest, simplest and most inexpensive house we can construct of matched stuff, there being no frame whatever. It was made in knocked-down



Plan for model back yard poultry house, 8 by 10 feet. Large blue print (working plan) can be obtained by application to the Poultry Department, Massachusetts Agricultural College, Amherst, Mass.

condition in order to ship and assemble quickly, but can be made stationary more cheaply. The boards on the front, rear and ends are nailed to 5-inch cleats at the bottom and top; the upper cleats being about 1½ inches from the ends of the boards to make room for the cleats on the roof. The roof boards are held in place by three cleats, and a 2-inch strip is nailed around the edge of the roof for a cornice. A simple door of matched boards and a frame for cloth, hinged at the top and wire-nailed over the opening, completes the building. A droppings board 20 inches wide and one roost 2 by 2 inches, each supported by cleats nailed to the ends; two dry-goods boxes about 14 inches square for nests; tomato cans, with one end removed, tacked to the wall for shell, grit and charcoal; and a small box for mash, equip the house. This particular house was made of native pine because we were fortunately able to get this as cheaply as any other matched material. The bill of lumber is self-explanatory.

Bill of Lumber for Poultry House 6 by 6 Feet, Amherst Retail Prices.

Lumber: —		
142 feet matched pine (sides), at $60 per M,	$8 52	
18 feet North Carolina roofers (droppings boards), at $45 per M,	81	
40 feet 1-inch square edge pine, at $50 per M,	2 00	
60 feet matched spruce, at $50 per M,	3 00	
5½ feet 2 x 4 inch spruce, at $50 per M,	28	
		$14 61
Hardware: —		
14 3-inch gate hooks and eyes, at $0.05,	$0 70	
1 pair 4-inch strap hinges, at $0.15,	15	
1 dozen ⅞-inch No. 8 F. H. B. screws, at $0.05,	05	
1 4½-inch safety hasp, at $0.30,	30	
$\frac{7}{12}$ dozen ⅞-inch No. 7 F. H. B. screws, at $0.05,	03	
1 pair 1¼-inch backflap hinges, at $0.10,	10	
1 dozen ⅞-inch No. 6 F. H. B. screws, $0.05,	05	
1 2-inch gate hooks and eyes, at $0.05,	05	
8 square feet 2-inch mesh hen wire, at $0.01½,	12	
2 pounds 6-penny nails, at $0.07,	14	
		1 69
Miscellaneous: —		
$\frac{5}{6}$ yard cotton cloth, at $0.09,	$0 08	
50 feet roofing paper, at $0.02¼,	1 13	
		1 21
Labor,		7 22
Paint and painting,		3 00
Total,		$27 73

Bill of Lumber for Poultry House 8 by 10 Feet, Amherst Retail Prices.

Lumber: —

2 2 x 3 inch 10-foot sills,	10 feet
2 2 x 3 inch 8-foot sills,	8 feet
2 2 x 3 inch 10-foot plates,	10 feet
14 2 x 3 inch 4 foot 6 inch studs,	31 feet 6 inches
2 2 x 3 inch 6-foot studs,	6 feet
1 2 x 3 inch 7-foot studs,	3 feet 6 inches
2 2 x 3 inch 6 foot 7 inch studs,	6 feet 7 inches
1 2 x 3 inch 8-foot door header and girts,	4 feet
12 2 x 3 inch 5-foot rafters,	30 feet
1 2 x 3 inch 8-foot roost,	4 feet
1 1 x 4 inch 10-foot ridge board,	3 feet 4 inches

A total of . . . 116 feet 11 inches, at $50 per M,	$5 85	
24 feet 1 x 2 inch for cloth frames, 4 feet, at $50 per M,	20	
175 feet matched roofers, roof and droppings boards, at $45 per M,	7 88	
210 feet novelty siding, at $60 per M,	12 60	
1 batten door 2 feet 2 inches x 6 feet 4 inches, 16 feet, at $50 per M,	80	
4 $\frac{7}{8}$ x 5 inch 5 foot 6 inch; 4 $\frac{7}{8}$ x 4 inch 5 foot 6 inch — corner boards, at $50 per M,	73	
4 $\frac{7}{8}$ x 2 inch, 12-inch eave strips,	25	
16 feet in length, 1 x 2$\frac{1}{4}$ inch braces and cleats under brooder coop and feed box, at $50 per M,	17	
		$28 48

Hardware: —

1 pair 4-inch T hinges and screws,	$0 15	
1 pair 4-inch safety hasp and screws,	25	
1 padlock,	1 10	
1 pair 1$\frac{1}{4}$-inch backflap hinges,	10	
12 2-inch black iron door buttons, at $0.02,	24	
6 pounds large head roofing nails, at $0.07,	42	
2 3-inch gate hooks and eyes, at $0.05,	10	
1 dozen 1$\frac{1}{2}$-inch No. 10 F. H. B. screws,	05	
27 square feet 1-inch mesh chicken wire, at 0.01\frac{3}{4}$,	47	
		2 88

Miscellaneous: —

1$\frac{1}{4}$ M asphalt shingles, at $7.60,	$9 40	
1$\frac{2}{3}$ yard cotton cloth for screens, at $0.09,	15	
		9 55
Labor,		21 80
Paint and painting,		7 00
Total,		$69 71

Yard: —

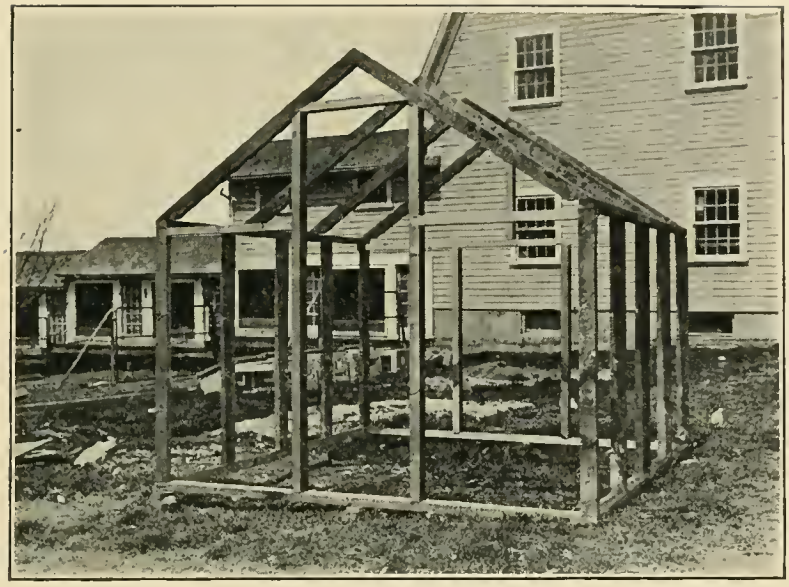
2 yards cotton cloth frames, at $0.09,	$0 18	
1 pair 4-inch strap hinges, yard gate,	15	
160 square feet 2-inch hen wire yard, at 0.01\frac{1}{2}$,	2 40	
3 2 x 4 inch 10-foot braces,	1 00	
5 4 x 4 inch 8-foot posts, chestnut, 53$\frac{1}{3}$ feet, at $35 per M,	1 87	
Labor,	1 00	
		$6 60

Feed bin: —		
15 feet square edge pine, at $50 per M,	$0 75	
38 feet matched pine, at $50 per M,	1 90	
½ pound 8-penny common wire nails, at $0.07,	04	
1½ dozen 1½-inch No. 10 F. H. B. screws, at $0.05,	08	
1 pair 4-inch heavy strap hinges,	15	
Labor,	1 55	
		4 47
Nests: —		
22 feet ⅞-inch square edge pine, at $50 per M,	$1 10	
½ pound 8-penny common wire nails, at $0.07,	04	
2½ dozen 1½-inch No. 12 F. H. B. screws, at $0.05,	13	
⅔ dozen 2½-inch No. 12 F. H. B. screws, at $0.05,	04	
1 dozen 1½-inch No. 10 F. H. B. screws, at $0.05,	05	
Labor,	1 33	
		2 69
Broody coop: —		
5 ⅜ x 1½ inch 12 foot (slats), at $50 per M,	$0 24	
1 dozen 1-inch No. 6 F. H. B. screws, at $0.05,	05	
$\frac{1}{12}$ dozen 1-inch No. 10 F. H. B. screws, at $0.05,	01	
1 2-inch backflap hinge, at $0.15,	15	
¼ pound 4-penny nails, at $0.07,	02	
1 2-inch iron door button, at $0.02	02	
Labor,	1 33	
		1 82
		$15 58

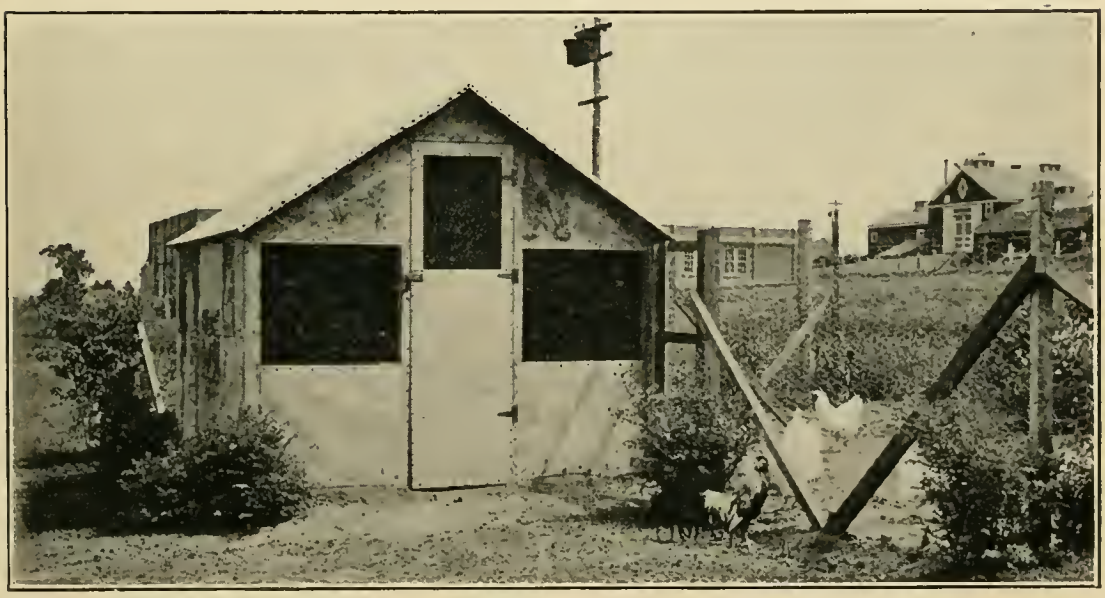
A very cheap coop can be constructed of piano boxes, removing the backs and placing them back to back, the slanting sides continued until they come to a peak, and the whole covered with commercial roofing.

A frame of any style desired can be erected and covered with boards from dry goods boxes and then with commercial roofing. Construction of this kind does not make a sightly house, but such coops can often be obscured from view by trees, bushes or buildings. Where these conditions exist, and one's vanity will allow, such houses can and should be used. However, one should think twice before placing an unsightly coop and yard where it will be an eyesore to a neighbor. This has had much to do with attempts to legislate poultry out of cities and villages.

Nest Boxes. — Nest boxes are a very essential part of poultry house equipment, and in constructing them the following points should be considered: seclusion, accessibility for both the hens and the attendant, sanitation and size. For general use the boxes should be about 14 inches square, and, if the birds enter



Frame of house shown below.



Back yard house, 8 by 8 feet, designed for locations where expense must be considered and appearance is not an important factor. Note shrubbery to improve appearance.

at the side, 12 or 13 inches deep. A set of nest boxes can be made in the form of a drawer and placed under the droppings board, as shown in the illustration, or a box with three compartments and a slanting roof like that of the feed box can be used, the front edges being 13 or 14 inches high, and the rear 18 to 20 inches. A strip 4 inches wide is nailed along the lower edge of the front to keep in the nesting material and eggs. This will allow plenty of space for the hens to enter. Two cleats nailed to the ends close to the bottom and projecting 6 inches in front will serve as a support for a strip for the hens to fly to when entering the nests. A more inexpensive nest box can be made from a dry goods box. For small hens an egg case or an orange box will make a satisfactory nest. However, in using boxes of any kind, arrange to have the hens enter at the side rather than at the top, as they should not be compelled to jump down into a deep box or case and thus cause a loss from unnecessary breakage. The nests should be well supplied with straw or other nesting material. Thousands of eggs are lost annually through breakage because hens are compelled to lay on bare or rough boards.

Broody Coop. — A coop is necessary for breaking up the broody hens unless a non-broody race, such as Leghorns or Minorcas, is kept. A slatted coop, similar to the one in the illustration on page 9, Fig. 2, approximately 18 by 24 inches, is ideal. It is made of slats $1\frac{1}{4}$ inches wide, placed 1 inch apart except on the end where the feed trough is located. There the slats are placed $2\frac{1}{4}$ inches apart to allow the hens to reach through for feed. A more inexpensive coop can be made by securing a box 15 to 18 inches deep and $1\frac{1}{2}$ to 2 feet square, removing the top and bottom, and from the boards thus removed making slats similar to those described above. It can be placed in the poultry house or hung under a tree. Provision must be made for feeding and watering.

Feed Bin. — A feed bin for holding sufficient mash and scratch feed to last the flock for three or four weeks is very convenient. Where grain is left in a barn or other outbuildings, or even in a basement, there is usually more or less waste by rats and mice, and having feed in the poultry house saves time and labor. The bin in the illustration is 15 inches wide, 3 feet

3 inches long and 20 inches high in front and 30 inches in the rear, and has a partition in the middle. Each section holds one bag of grain or mash which allows the grainman to empty the feed, thus avoiding unnecessary handling by the owner. The slanting cover prevents the birds from roosting on it, which is conducive to cleanliness. For cheaper construction, a suitable dry goods box may often be obtained, but the cover should be made to fit securely enough to keep out rats and mice, and constructed with a slanting top if possible.

Yard and Fence.

It is much more humane and sanitary to have a small yard for a back yard flock, and most people with extensive observation along this line feel that birds do better than if kept housed, and their general health is improved by sunshine, fresh air and exercise out of doors. It is possible to keep hens, if exceptionally good stock, confined to the house throughout the year, but we do not advise doing so. The size of the poultry yard will depend upon the size of the back yard plot, nature of soil and amount of space needed for the garden. A place 8 or 10 feet wide and 15 to 20 feet long will answer. A 5-foot fence made of 2-inch mesh wire will do for practically all breeds. Leghorns will fly over a 6-foot fence when kept in close confinement, but by clipping the flight feathers from one wing they will not "go over the top." Posts 4 by 4 inches, and braces 2 by 4 inches, with a gate similar to the one shown in the cut facing page 7, make a neat, durable fence. It saves fencing to have the poultry house in a corner of the yard, but it is more desirable to have the rear fence two or three feet from the house so that the hens can get on the north side of it during hot days in summer and on the south side in winter. Berry bushes and grapevines can be placed along the fence just outside of the yard. Some of the roots from these bushes make their way under the fence and thus, underlying the poultry yard, get all the nitrogenous fertilizer they need, but not an excess. Splendid crops can be obtained each year without much additional fertilizer, except a slight amount of phosphoric acid and some potash. The hens will reach through the fence as far as they can and help keep down the weeds and grass.

Utensils.

For Feeding. — A dry mash hopper should be provided. It may be home-made or one of the many patented ones on the market, as most of them are quite satisfactory. The essential characteristics of a good dry mash hopper are its efficiency in preventing the hens from wasting the mash, and its size and cost. A hopper for a dozen hens should hold half a peck at least. A box about 1 foot square and 10 inches deep makes a good hopper. A piece of 1-inch mesh wire stapled to a light frame that fits inside the box and laid on the mash after the box is about two-thirds full allows the hens to eat it through the meshes, but they are unable to scratch it out. A small trough, worn-out basin or something of that kind can be used for wet mash feeding.

Water Fountain. — A water fountain for twelve hens should hold at least 2 quarts, and one holding 3 quarts is preferable. A small pail or deep basin 8 or 10 inches across makes a very good drinking fountain. A half-gallon stone jar can be used by adults who handle equipment more carefully than children, but it is easily broken. Water should not be allowed to remain in it over night in freezing weather. There are a large number of water fountains on the market, most of which are satisfactory. Care must be taken to keep the water dish clean. It should be scalded or disinfected regularly.

Shell and Grit Boxes. — Almost any kind of tin can or box can be used for grit, shell and charcoal; the only objection to the patented devices is the price. The writer has found that the 1-quart tomato cans will answer for this purpose by removing the top and driving a nail through the upper edge of the can for support.

Receptacle for Droppings. — A container for poultry manure should be provided; a box or barrel with rain-proof cover, put in a convenient place, will answer very well. The cover should fit tightly in order to keep down the breeding of flies and prevent odors from escaping.

Litter.

The value of exercise for hens kept in close confinement cannot be overemphasized, and one of the best ways of inducing it is to throw their scratch grain into litter. There are a num-

ber of materials available for this purpose. Use something that is a good absorbent, easily scratched about by the hens, fairly cheap, and the more valuable it is as a fertilizer the better. Two or three inches of sand spread over the floor, and over this a few inches of straw, make an ideal litter. Loam is fine and dusty and packs too easily. Baled shavings are often used with good results, but they are easily broken and mixed with the sand. Leaves are satisfactory for a time, but soon become fine and lose their value as litter, but should be used when possible.

Feeds and Feeding.

Grains and Scratch Feeds.

A scratch feed, so called because the hens are obliged to scratch in the litter for this portion of the ration, may be composed of a single grain or a mixture of several grains. Those most commonly used for this purpose are corn, wheat, barley, oats and buckwheat, and are given in the order of their importance as poultry feeds. At the present time corn is one of the most expensive grains we have, but in normal times the cheapest. It is usually cracked before feeding in order to give the hens more exercise in finding it. If cracked corn is not sifted before feeding, the mealy portion will be lost in the litter. Before the war we recommended a scratch feed containing 2 quarts cracked corn, 1 quart wheat and 1 quart oats, but wheat became so high in price and so scarce that the Food Administration prohibited its use in poultry feeds in amounts greater than one-tenth of the mixture. This resulted in a meeting of representatives from the eastern colleges, who adopted a war scratch feed composed of 5 pounds cracked corn, 1 pound wheat, 2 pounds oats, 2 pounds barley. This was in December, 1917. Since that time some grains have become very scarce and others are unobtainable, so that at the present writing the poultrymen are compelled to use almost any combination of grains, and the proportion of each depends entirely upon price and availability. We must not be too particular about proportions these days. Due to the fact that mash is cheaper than scratch feeds, a

larger proportion should be fed than formerly. In many sections of the State back yard poultry keepers will probably be unable to buy in small quantities the various grains mentioned, and may have to resort to commercial scratch feeds. However, in buying, it is well to examine them very closely and see that they are made up of sound, sweet grains. A splendid way to test a scratch feed is to smell and taste of the various grains. This will enable the purchaser to determine whether or not they are musty or moldy. If a scratch feed is composed largely of chaffy oats or barley it will contain a large amount of fiber, and consequently be low in feeding value.

Mashes.

A mash is a mixture of ground grains and by-products, such as ground oats, corn meal, bran, middlings and meat scraps. A dry mash, as the term signifies, is one that is fed in a dry state, and a wet mash is one that is moistened with water or milk before feeding. Mashes are fed in order to make use of the by-products, and, being quickly digested and rich in animal protein, are very forcing. Some feeds or materials that cannot very well be used alone can be incorporated into mashes. For these reasons we have adopted the system of feeding our hens a ration consisting of part mash and part scratch feed. The following mash is recommended to those who can buy the various ingredients and wish to do their own mixing: equal parts by weight of wheat bran, wheat middlings, corn meal, ground oats, gluten feed and meat scraps. It is not necessary to add salt, but if one desires to do so use about as much as put in human food. As in case of scratch feeds, many back yard poultry keepers will probably be unable to buy the various ingredients, and will be compelled to depend upon commercial mashes. In buying these it is well to study the analyses and select one that is fresh, sweet, palatable and fairly low in fiber, as hens cannot easily digest it.

Green and Succulent Feeds.

It is natural for hens to eat green feed, and it is surprising how much they will consume if tender and palatable. Most green stuffs grown in the garden — lettuce, cabbages, radish

tops, spinach, beet tops, etc. — are relished by them. Lawn clippings are also good. For winter use, mangels, beets, turnips and carrots can be split open and fed. Beet pulp has about the same feeding value as fresh beets or mangels, and can be soaked and fed in about the same quantity. These materials are not great egg makers in themselves, but they keep the hens in good condition and act as appetizers.

Animal Feed.

Hens need some kind of animal feed, and it is given to them by nature in the form of bugs, insects and worms. Hens yarded are unable to secure these, so that meat scraps, green cut bone or milk is fed instead. Meat scraps are mixed with the mash; green cut bone is usually fed in a trough or on the litter, and milk can be mixed with the mash or fed in a trough, jar or pan. All these should not be fed at the same time. An ounce per bird of green cut bone every second day is sufficient. The hens can be given all the milk they will drink, and it is usually soured before feeding, although this is not necessary. In many places green cut bone can be secured at the butcher shop from fall until spring, or during the cold season. It would hardly pay to buy a feed cutter to do the grinding for a back yard flock, as it is too expensive.

Grit.

Grit is usually given to the hens to assist in grinding the coarse feed. Some people think this is not necessary, but most poultrymen feed it.

Oyster Shell.

Oyster shell is fed because the hens need more lime for egg shells than they get in other feeds.

Charcoal.

Charcoal is fed to poultry in a granular form in hoppers, or mixed with the mash in either a granular or powdered form. Its use is not absolutely essential for healthy stock. If hens appear dumpish or get off their feed a little charcoal may be used.

Table Scraps.

Table scraps are very palatable and therefore forcing. Almost all kinds of scraps can be fed except pickles, orange and banana peeling, coffee grounds and things that are very salty. They should not be allowed to accumulate but fed daily if possible, especially in warm weather. One should not forget that his neighbors are generally glad to have their waste used for production. It is particularly true during this period of stress, when feeds are so high and we are being urged to conserve in every way. Wasting food these days for either man or beast is unpardonable.

Method of Feeding.

Most back yard flocks consist of about twelve hens, so the amounts mentioned will be sufficient for that number. Those having a larger or smaller flock can feed a proportional amount. It must be kept in mind that the back yard flock is kept for egg production, and the method recommended is very forcing. The following is for general use: The dry mash is kept before the hens in a hopper at all times, and, if a very forcing method is desired, some of the same mash can be moistened with water or milk and fed once a day. The table scraps may be added to the wet mash or fed separately at the discretion of the owner. It makes very little difference when the wet mash is fed, but it should be given at a regular time each day. The writer feeds his wet mash as early in the morning as possible, because it is more convenient to do it at that time. If fed in the morning table scraps can be fed at noon, which gives the hens two palatable feeds of forcing material daily. If one has milk to incorporate in the wet mash some of the meat scraps can be left out. A mash should not be thin and sloppy, but only enough milk or water added to make it crumbly. A dozen hens will eat from 1 to 2 pints of wet mash at a time, depending upon how well they like the dry mash and the palatability of the wet mash. They should not be given more than they will consume in a few minutes; the feeder can soon determine the exact amount. If table scraps are very abundant the amount of wet mash can be reduced considerably unless table

scraps are incorporated in it. The grain mixture or scratch feed should be fed in the litter morning and night, the latter feeding to be given early enough so that the hens will have time to fill their crops before going to roost. Usually 2 to 3 pints of scratch feed will be sufficient for twelve hens per day, about one-third of which should be fed in the morning and the balance in the afternoon. Cutting down the amount of scratch grain will compel them to eat more mash, and, as the latter is less expensive than the former, it is wise to encourage the hens to eat a large proportion of the cheaper feed. It is impossible to give the exact amount of feed for a flock of hens, as the quantity depends upon several variable factors. If hens were all of the same size and activity, laid the same number of eggs of the same size and weight, and all had the same power of digestion, the amount could easily be determined; but as these are variable factors it is impossible to specify a definite amount of grain. The amount of feed given is governed by quantity of grain found in the litter and hoppers at feeding time; this is a good gauge for the amateur. The feeding should not become too mechanical. The attendant should take plenty of time to do this important chore, and before scattering the grain in the litter should examine it to see if any grain is left from the previous feeding, and also if the wet mash has been eaten. After throwing out one or two handfuls of grain he should step back and see how the birds take to their feed. A good feeder will occasionally feel of the birds' crops while they are on the roost at night. The judgment of the attendant is an important factor in feeding hens. Fresh water, oyster shell and grit are kept before the hens at all times. Mangels, beets and cabbages are fed during the winter months, supplemented with sprouted oats, but during the summer rape, spinach, Swiss chard, turnip tops and other green stuff are given in abundance. The green stuff is simply thrown into the yard, but the beets, mangels or cabbages can be hung from the ceiling with a string, high enough for the hens to pick, or they can be split open and placed in a trough or in a corner of the building, or jammed on to a spike driven into the wall. It is very important that the hens have plenty of water. I have visited poultry houses and found the water fountain empty and dry. There is no surer

method of cutting down egg production than an insufficient supply of water. During hot weather the hens drink more than at other times. By noon in the coldest weather the water may be frozen so that more should be given early enough for the hens to drink all they want before going to roost.

Production and Conservation of Poultry Feeds.

Production.

Unless the garden plot is very small a portion can be set aside for raising poultry feeds, or a near-by vacant lot or plot can be rented or its use may be donated. The use of two large lots was offered the writer by a patriotic fellow townsman, free of charge, for the sake of increased production. Even a small plot of Flint or Dent corn will help out considerably, and sweet corn that becomes too hard for family use can be fed to advantage. A patch of rape for summer use, and a few rows of beets or mangels for winter, will reduce the feed bill appreciably and add to the health of the fowls. In case one has two yards the hens should be confined to one, and the other used for crops. This is no time to say we have not land enough to make it pay. Every available foot of ground should be used. I am told that in England if a plot of ground the size of a handkerchief is available good use is made of it. Why not here?

Conservation.

Because of the low cost of feed during the pre-war period many poultry keepers acquired wasteful habits in feeding, and with the price of poultry and eggs comparatively high they were able to get along without loss. But the time has come when every effort must be made to save and make every pound of feed go as far as possible. Avoid buying commercial scratch feed containing a large amount of weed seeds or fine materials that may be lost in the litter or that may be composed of poor or chaffy grains. A little practice will enable the purchaser to distinguish between good and poor quality. One way to test a scratch feed, in addition to close examination, is to sweep the litter and dust from a portion of the chicken yard or floor and throw a handful of grain down for the hens to eat, or some may

be placed in a trough or other receptacle, and after the hens have helped themselves examine what remains. If the birds are hungry at the time and fed less than they need, only refuse will be left. In purchasing cracked corn see that it is free from meal, as it will be lost in the litter if fed in the usual way. However, if the cracked corn contains a large amount of meal, providing it cannot be sifted, it should be fed in a trough or hopper in order to save the meal. Occasionally one is offered oats or barley at a special price, but it may be composed largely of hulls. Most wheat on the market is suitable for feed, but wheat screenings should be examined very carefully before purchasing. If composed of 25 or 30 per cent weed seeds they are very expensive at any price. The feeding of large quantities of green and succulent feed, such as mentioned in another paragraph, will greatly decrease the feed bill. It is a very common practice to feed such materials as these once, twice or three times a week, but they should be fed daily. It is well known to poultrymen that hens on a large range require much less concentrated feeds than when confined. The back yard flock cannot be given a wide range, but if the garden is large or not adjacent to the yard and the lawn near by, the hens can be let out occasionally for a half hour or an hour near roosting time. The more feed the hens gather for themselves the more the feed bill is cut. The hens will not get too fat if they eat an abundance of mash, as this is not so fattening as grain. Do not let the hens waste the mash. It should be fed in what may be termed a "no waste" hopper. If the hens scratch it into the litter, adjust the hopper. Do not feed rats and mice on the high-priced grains; better catch the rats and mice and feed them to the hens. No unprofitable stock should be kept during a period of high grain prices and intense conservation. (See paragraph on "Culling," page 29.)

Poultry Management.

Selection of Breed or Variety.

The points to be considered in selecting a breed or variety are size, shape and color of both the fowls and eggs, as well as the use to which they are put. As far as vigor, or hardiness,

and egg production are concerned, very little can be said in favor of any one breed. The records of both private individuals and experimentations bear testimony to this statement. Some writers make the following classifications: egg breeds, general purpose breeds and meat breeds. This scheme works out better on paper than it does in either practice or theory. In the first class they place the Leghorns, Minorcas, Anconas, Campines, etc.; in the second, such breeds as the Rhode Island Reds, Wyandottes, Plymouth Rocks and Orpingtons; and in the third class, the Brahmas, Langshans, Cochins, Dorkings, etc. This classification is objectionable if it leads people to believe that the first class will produce more eggs than either of the other two, or that the third class is used for the production of meat more than either of the others, because in many sections of the country those in the second class are used primarily for eggs, and in other sections they are used wholly for meat. Those in the first class are small, except the Minorcas, non-broody, lay white eggs and can fly higher than the others. Those in the second class lay brown or tinted eggs, are of medium size, prone to broodiness, have clean shanks and make excellent mothers. Those in the third class are large, lay richly colored brown eggs, have feathered shanks and have the broody instinct well developed. Black or dark-colored varieties show pin feathers if plucked when young or not in full plumage, but when they have a full coat their bodies are clean and present a fine appearance. White chicken feathers bring 10 cents more per pound on the market than colored ones. On the other hand, white fowls when kept in close confinement do not appear as clean as colored ones on account of the ease with which their feathers are soiled. There is as much variation in age of maturity in different strains of the same variety as there is in different breeds. For instance, I have had Light Brahmas laying at six months and Leghorns at seven to eight months of age, but this, of course, is not usual. As a rule, those in the first class will mature in five to six months, and under good conditions those in the second class, from six to seven months; those in the third, from seven to nine months. It is important to remember that the breed is determined by the shape or type, variety by color, and that

the family or strain depends wholly upon the breeder. It is evident, therefore, that the characteristics that have to do with egg production, such as vigor, broodiness, inheritance, etc., are controlled by the breeder, and are not fixed breed or variety characteristics. Many of the faults that are being laid at the door of certain breeds are due to imagination, bad management or lack of skill on the part of the breeder. Other things being equal, one should select the breed or variety he likes best, as he is more likely to succeed if he is interested in his birds.

Size of the Flock.

The size of the back yard flock is usually determined by the size of the family, the amount of space and capital available, the size of the garden, demand for eggs on the part of neighbors, and the amount of table scraps and other waste. A flock of eight to ten will supply a small family with table and cooking eggs, and some to spare during the spring months. The surplus eggs can be sold to neighbors or put down in water glass. An average of one and one-half to two hens per individual in the family is a good guide. However, much depends upon how freely eggs are used for breakfast and substituted for meat.

Hens versus Pullets.

The question is very often asked, "Shall I buy hens or pullets?" This depends very largely upon the period under consideration. In the spring of the year I would advise buying hens, keeping them through the summer, and disposing of them in the fall; but in September, October or later buy early hatched pullets that will begin laying by the last of October at least, if you expect to make a very profitable venture of your poultry work. There are some who will do well with late hatched pullets of a good laying strain, but with prices of eggs extremely high in the fall it is very desirable to secure pullets that will give a good production during this period. Perhaps all back yard poultry keepers do not know that hens — that is, females a year old the preceding spring — will molt some time between the 1st of July and the 1st of January, and that it requires from two to three months or more for them to shed

their feathers, grow a new coat and begin to lay. Exceptional birds will not require as much time as specified, but they are not very common. Considering, then, that hens require a long resting period during the molt, it is easily understood that pullets will be much more profitable.

Males in the Back Yard Flock.

A male is not necessary for egg production, and should be kept only when eggs are being saved for hatching. Comparatively few back yard poultry keepers raise their chicks, and those who do will find it more profitable to buy hatching eggs or baby chicks from a well-known breeder keeping good stock than to purchase a male and feed him for a year. A good male will cost not less than $5, and cannot be fed for less than $4 per year. When killed or sold for meat he will bring $2 or less. Moreover, he is likely to injure some of the females, and his crowing is considered a nuisance by most neighbors; in fact, this very thing has done more than anything else to legislate poultry out of cities and towns. Therefore if a male is kept for breeding purposes dispose of him as soon as the breeding season is over.

Purchasing Stock.

In purchasing stock or hatching eggs it is advisable to apply to reputable poultry breeders or consult a neighbor who is interested in poultry and widely acquainted with poultrymen. Too often people buy from a distance and ignore their neighbors. We believe this to be a great mistake in many instances, as there is plenty of stock in almost every community, and the home people should be patronized when possible. In Boston there are two or three firms who buy and sell pullets, hens and baby chicks, and there may be such firms in other cities. These should be patronized, and they may be able to put you in touch with some one who has exactly what you want in the way of stock. Because of the comparatively small number of chicks raised this year there may be a scarcity of pullets in the fall. It is advisable, therefore, for back yard poultry keepers to place their orders for pullets as early as possible. As a matter of fact, this condition may prevail throughout the entire war

period, and it will be nothing uncommon for orders to be placed six months or even a year in advance. Delay in ordering may prevent many from keeping a back yard flock.

Laying Indications.

The laying hen has a well-developed comb and wattles, red in color, but not necessarily bright, as many suppose. The eye is bright and the head has a healthy appearance. She is alert, very active and always ready for food, — one of the first to come down from the roost in the morning and the last to retire. If the hens are observed for a short time before going to roost, those that are laying will be seen visiting the shell box, occasionally several times during a period of fifteen minutes. The abdomen is well filled out; this does not mean that it must be over large or baggy in appearance. The pelvic bones near the vent are well separated; usually three fingers, side by side, can be placed between these. However, this is not an absolute criterion on account of the varying size of hens or pullets, even of the same breed. The edges or lips of the vent appear somewhat enlarged. By comparing the vents of laying hens with those of the male birds or undeveloped pullets the amateur will have a thorough understanding of what is meant. The above does not refer to the number of eggs that a hen has laid or will lay, but is merely an indication of a laying hen at any given period.

Characteristics of Layers.

Much study has been given recently to the disappearance of the yellow pigment from the shanks, beak, skin and other parts of the bird during the laying period. This applies, of course, only to those varieties that have yellow shanks and skin. When the pullet begins to lay in the fall or early winter, or the hen after the molting period, she has a fairly good supply of yellow pigment in the parts mentioned, but as the laying period advances, the pigment gradually disappears so that the comparative amount at any given period is a fair indication of the laying quality of the bird. I wish to emphasize the term *comparative* because hens and pullets vary considerably in the amount of pigment at the beginning of a laying period. This fact must

not be lost sight of, or one may misjudge his birds. If I examine a pullet in March and find the shanks, beak, skin, lips of vent and edge of the eyelid well supplied with yellow pigment or an orange color, I at once assume that she has not been laying well. If a hen, I assume that she did not recover from her molt until fairly late in the winter. If I find these parts pale, I assume that the bird has been laying heavily, provided she had the normal amount of yellow pigment in the various parts mentioned at the beginning of the laying period. Again, the general condition of the laying hen is a fair indication of her laying qualities. The hen, during the summer months, that has kept her coat in fine condition, no feathers broken or faded to any extent, is one that has probably not climbed in and out of the nest box very often, or has not busied herself working for egg-producing materials. The good layer is likely to have a "ragged" appearance during the summer, — broken, dirty feathers, and her comb may not be extremely bright red, due to the heavy drain upon her for eggs.

Getting acquainted with the Individuals.

Hens differ in appearance, disposition and actions as much as human beings do, but because of the large numbers kept together, and the little attention given each, they look alike to the casual observer. The same thing would be true with cows if each was not stalled, cared for and milked separately. Getting acquainted with the individual hen is desirable from the standpoint of both pleasure and economy. The man with hundreds of hens to care for, together with a multiplicity of other duties, finds it impossible to know the individual, her numerous qualities and characteristics, merely through observation and contact in making his daily rounds; he resorts, therefore, to the trap nest or other means. But the man with ten or twelve hens, if he has the inclination, can soon learn to distinguish the various hens in his flock and determine quite accurately the number of eggs laid by each, together with other interesting and important characteristics.

One who has had little experience with poultry should, by all means, leg band his pullets. There are various kinds of bands for this purpose, but the colored ones, easily distin-

guished, are recommended. These can be purchased in any quantity desired, or in sets of a dozen or more different colors. By the use of colored bands, a separate color for each individual, one can easily distinguish the different birds without handling, or when at a distance. This is quite advantageous, as it gives one a much greater opportunity to study the individuals than if it were necessary to catch the bird and examine the leg-band number in order to distinguish her from the others. When one is able to recognize each hen, either by leg bands or certain physical differences, there are several important characteristics that he is able to study. For example, he will notice the hustlers, the time each hen begins to lay and when she stops, or, in other words, the length of the laying period; the general physical condition of each bird; the length of the molting period; immunity from disease, or the ease with which they are affected; the degree of broodiness; the nature of the eggs, that is, size, shape and color. All these points have an economic value. The hustling or hard-working hen is usually a heavy layer. There is enough difference between the eggs of hens in the same flock to make those from one worth 10 cents per dozen more than those from another. Again, it is very important that the degree of broodiness of the various hens in a flock be known. By the use of leg bands or any other method of studying the individual the owner is able to determine how long it takes to break up each hen; also how often she becomes broody. In making a study of our college flocks we have found hens that become broody ten to twelve times per year, losing one hundred and fifty or more days from broodiness, whereas some were not broody at all, and others not more than once or twice. Armed with these facts concerning the various hens the owner will not hesitate in selecting a hen for the Sunday dinner or the butcher. It is, therefore, easily seen that a thorough knowledge of a back yard flock may be the cause of one's success, as the "boarders" or non-productive birds can easily be eliminated. Much interest in the birds themselves usually results from a careful study of the individual, — a factor of great importance.

Culling.

During this period of high cost of feed the question of eliminating the non-producers is receiving more attention than ever before. It is very hard, indeed, to give specific directions for culling a flock of pullets in the fall of the year. For example, if you purchase a flock of twelve pullets, how can the inferior ones be culled? In buying them you hope to get all high-producing birds, but usually in a flock of twelve to fifteen there may be one or two that are unprofitable. We have given the characteristics of a high-producing bird and also of one that is laying. These should enable you to detect the layers, and therefore distinguish those that are slow in maturing. If a pullet does not increase in weight, show comb development or other signs of laying, and this condition continues for a few weeks, I certainly would use her for a Sunday dinner; but if she is increasing in weight and growing she is merely late in maturing, rather than a bird whose tendency to lay eggs is below normal. Under the study of the individual I have mentioned the subject of broodiness; birds that have this tendency developed to such an extent that production does not pay for the feed consumed should surely be disposed of. Again, if birds stop laying and begin molting in July or August, and the owner does not intend to dispose of the flock until September or October, such birds should be disposed of at once because they will probably not begin laying during the remainder of the year. Any birds that appear anæmic, or are "going light," as most poultrymen express it, should be removed from the flock, and if there is no improvement, killed and buried deeply, or burned. By close observation and study the practical back yard poultryman or woman can cull the flock to such an extent as to change a possible failure into a profitable venture.

Breaking up the Broody Hen.

Those who have not kept data on broody hens do not know the tremendous loss that may be sustained by not breaking them up as soon as detected. When one realizes that in an ordinary flock there may be 25 per cent broody at one time, even when broken up as soon as noticed, it is easily understood

that egg production will be greatly reduced if these hens are not looked after carefully. Many poultrymen make a great mistake by allowing the hens to sit on the nests two or three nights before placing them in the broody coop. By visiting the poultry house every evening at dusk, those found on the nests can be placed in the broody coop and kept there for three or four days. It is a good plan to let the hens out of the coop when the flock is fed in the afternoon or evening. Those that go back to the nest should be again placed in the broody coop for about three days more. About 85 per cent will be broken up in three days, but there are some in which broodiness is so strongly developed that it requires from six to eight days, and occasionally longer. If, when the hens are released, they go on to the roosts at roosting time, instead of the nests, their broody spell is broken. Many people think it is necessary to starve broody hens in order to break them up quickly, but this is an erroneous idea. The aim of the poultryman is to bring them back to laying as soon as possible; therefore give them plenty of water, mash, grain, green feed, and if there are any feeds that are especially palatable or tempting, give them to the broody hen. The sooner they are broken up and begin laying the sooner they become a source of revenue.

Responsibility.

In order to have hens do well it is necessary that they be fed and watered regularly, and that the house be kept in a sanitary condition. I am sure that in a family of four or five, no one of which has a definite responsibility in regard to the care of the flock, the hens will suffer, with a consequent decrease in egg production. Therefore we highly recommend that the responsibility of the care and management of the flock be definitely placed. It does not mean that any one member of the family must assume this all the time, but if the work is to be divided, it should be definitely understood just what portion each must do. Of course it is better to place the management of the flock in the hands of one person, but if this cannot be done, the work can be divided so that one member of the family can do the work in the morning and another in the evening, etc. Division of responsibility usually means neglect or trouble of some kind.

Gentleness.

No other animals on the farm respond to kind treatment as readily as hens. It is advisable, therefore, to be gentle with them; in fact, make pets of them if possible. If they are frightened by catching, or by dogs or cats, egg production is likely to drop, and some may be injured by jumping against the sides of the building or equipment, such as mash boxes, hoppers, etc. They may be hurt internally as well as externally. A broken egg within a hen sometimes results from fright. The majority of poultry keepers are very proud of their birds, and like to show them to their friends and neighbors, but if they are scary, when visiting the poultry house the owner should precede his guests, as the hens will not be so badly frightened as though a stranger entered first. As a rule, it is better to make observation from outside the yard rather than to go into the house. Of course, if the hens are tame, it will make very little difference.

House Management.

It is very difficult indeed to give general directions for regulation of the openings of a poultry house, because so much depends upon the location, the nature of the openings, the time of year, the temperature and the hens themselves. The house should be free from draughts and moisture. If the latter gathers on the ceiling in drops or in the form of frost on the glass, if any, the house is too close and should be opened or ventilated. Dry and draughtless houses will do much to insure healthy birds, and therefore good production. The following directions have reference to the house illustrated in the preceding pages. Unless Leghorns, or some other Mediterranean breed, are kept, the opening in the door and the one just above it need not be covered with cloth, but if one of the above is kept it may be necessary on the coldest nights to cover these two openings with some kind of cotton cloth or burlap. During the coldest nights the other two openings should be closed with cloth screens provided for this purpose. If the weather is fairly moderate only one is necessary, and if very mild both screens should be left out. During the summer months both screens should be removed and the door left open

nights unless you are in a thieving district, in which case it is advisable to lock it. However, thieves who are very anxious to get hens may carry shears and cut the wire. The droppings board can be cleaned daily, every other day, twice a week or once a week, but during the fly season it should be cleaned at least twice a week in order to keep the flies from breeding. The ventilator in the rear of the building should be opened only during the warmest weather, at other times it should be kept closed to avoid draughts. Be sure during the winter months that this opening is closed tightly. If necessary, a small piece of paper can be tacked over it on the inside. It is well to keep the dust brushed off the various pieces of equipment in the house.

Care of Poultry Manure.

As poultry droppings are very valuable fertilizer, special pains should be taken to preserve them. For best results the droppings should be removed daily and placed in a barrel or box, at which time a little loam, road dust, sawdust or acid phosphate, or any combination of these, can be sprinkled over them. The main thing is to use something that will absorb the moisture and prevent the escape of nitrogen. Do not use wood ashes or lime for this purpose, as a chemical combination will be formed which will result in the loss of most of the nitrogen. Some poultrymen sprinkle chemicals or loam over the droppings board after the droppings have been removed, but this method is not desirable because hens do a great deal of wing flapping in the morning before coming from the roosts, which blows most of the chemicals and loam from the droppings board and they are lost in the litter. Again, this literally covers the inside of the poultry house with dust. If well preserved, the droppings are worth 30 to 40 cents per hen annually, so it pays to take care of them. If you have a garden the droppings can be spread on it during the entire year when taken from the droppings board, or they can be spread during the summer months and stored in winter.

Yard Management.

About the only attention that is given the poultry yard during the winter months is to keep the snow shoveled away from the south side. Enough should be removed to allow the

door to open and shut freely, and to keep the ground exposed if possible, so that on warm days, when the door is left open, the hens can come out for sunshine and fresh air. Some people believe that hens are badly injured by walking on the snow, but this is erroneous. During the summer months, especially if the yard is small, much attention should be given it, or the surface of the ground will become badly contaminated and odors will be sent forth throughout the neighborhood after a warm rain and hot sun. Frequent cultivations are therefore necessary. One of the best methods of handling a poultry yard is to spade it once in two or three weeks and sow oats, covering them as well as possible with a rake. The hens can be turned out of the house immediately after the oats are sown. For the first few days they will be scratching out dry oats, and for the next few days sprouted oats, and later will be eating the green shoots as they come up. After a period of two weeks the ground will have been worked over thoroughly by the hens, and the process of spading and sowing can be repeated. A larger yard can be divided into sections by a movable gate or gates, and while the hens are working over one part of it, oats or rye can be started in the other portion, and an alternating system throughout the summer used. This method of yard management makes the hens work for their food out in the open air, — a very good health renewer. If grapevines, trees, berry bushes or other vines are not planted around the outside of the yard it is well to sow sunflower seed early in the spring. The seed should be planted a foot or more from the fence, so that the hens cannot reach through and eat off the small plants as they come up. These will furnish splendid shade during the hot summer months, and the seed will make valuable fall or winter feed.

Poultry Hygiene.

As most back yard poultry keepers purchase pullets each fall and keep them until the following summer, there should be a thorough housecleaning after the hens are sold, so that the new flock may find their quarters absolutely free from disease germs. The old adage "Cleanliness is next to Godliness" is very applicable to poultry work, due to the fact that hens are kept in flocks and handled collectively rather than individually,

as is the case with most other farm animals. General health of fowls depends very largely upon the number of disease germs they carry. They, like human beings, can withstand and ward off disease when only carrying a limited number, but when the system becomes overloaded the germs get the upper hand and disease follows. Isolate sick birds as soon as detected, no matter what the symptoms are, and as long as they remain in the detention coop always care for the flock before tending the sick ones, and thus avoid the possibility of further contamination.

Disinfectants and Medicines.

There are very few things of this kind that the average back yard poultry keeper needs. It is necessary to have a good disinfectant; most of the coal tar products on the market are suitable, and if used according to directions will prove satisfactory. Standard disinfectant is one of the cheapest and most reliable. It should be used in a 3 per cent solution. A great many people make a mistake by throwing only a light spray of disinfectants. They should be used freely or until the materials sprayed are well soaked or the disinfectant stands in drops. The above is recommended for spraying at the annual housecleaning time, or disinfecting equipment and utensils generally. For painting the roosts and adjacent parts for mites use 8 parts kerosene and 1 part crude carbolic acid, or any of the coal tar disinfectants such as the Standard. This should be applied freely with a brush. About the only medicines that one should keep are epsom salts, sweet oil and possibly carbolated vaseline.

Annual Housecleaning.

Remove all utensils and movable equipment such as roosts, droppings board, nest boxes, broody coops, etc.; sweep the walls and ceiling of the house very carefully, removing all dust and cobwebs. The litter and sand should be spread on the garden, as it is valuable for fertilizer. Then give the walls another sweeping after which spray thoroughly with disinfectant. The utensils should be washed, disinfected and dried thoroughly before putting back. Two or three pails of scalding water and a broom will do wonders in destroying germs, lice,

mites, etc.; use this freely. Whitewash may be used instead of disinfectants, but it should not be allowed to stand more than thirty-six hours after mixing, as it loses its disinfecting powers very rapidly. Whitewash is not entirely satisfactory for a small poultry house because it is very difficult to make a whitewash that will not rub off freely, and the professional man is continually soiling his clothes. Whitewash, if used, can be spread with a brush or thinned and put on with a spray pump.

Colds and Roup.

These two diseases are treated under the same head because they are so much alike in the initial stages. At times the poultryman will not know whether the hens are affected with roup or merely colds. The symptoms are running at the nose, coughing, sneezing, a rattle in the throat, and, after the initial stage, inactivity and standing about with ruffled feathers. In the latter stages of roup the head may be swollen and eye bulged out; oftentimes an abscess forms below the eye. In the worst stages of roup, that is, the diphtheritic type, yellow patches are seen in the throat. This disease may appear any time during the year, but is more prevalent in the fall and late spring immediately following the heavy laying season, which evidently lowers the vitality of the birds and allows these germs to get a foothold. The flock should be kept under close observation at all times, and all affected birds, as soon as detected, placed in a coop or box until they have recovered. If they grow worse the best treatment is to use an axe or hatchet and burn or bury the carcass. By isolating, changing the drinking water often, and keeping the utensils clean much can be done to keep down this disease. Roup is probably one of the most serious diseases with which poultrymen have to contend. It seems almost impossible at times to eradicate it without disposing of the entire flock, cleaning and disinfecting and starting with new stock. Every year a large number of birds die of it, and the egg production of others is lowered at times from 25 to 50 per cent; therefore any one keeping hens should not allow this disease to get beyond his control.

Indigestion.

Fowls closely confined and fed mostly on rich, concentrated feeds are very likely to have indigestion. A glance at the droppings board in the morning will reveal the presence of any trouble of this kind. Normal droppings are quite firm and keep their shape. Thin or watery droppings indicate diarrhœa. If such are noticed, endeavor to find the affected bird. A badly soiled fluff may assist in finding her. Such birds should be given a dose of epsom salts or sweet oil. If left until they mope about, the majority cannot be saved. From one-half to one teaspoonful of epsom salts or 2 to 3 teaspoonfuls of sweet oil are sufficient for a dose. The latter is best administered by turning down the throat of the bird. The former can be dissolved in a little water and given in the same way, or, if the entire flock is treated, dissolve in water and mix with soft feed. Have the birds hungry so that each will get a share. It is advisable to treat a flock once in six or seven weeks with epsom salts, even if no symptoms manifest themselves. Some poultrymen who feed a definite amount of dry mash daily occasionally add a little epsom salts. Neighbors often throw scraps and waste material into the yard, but this plan is to be condemned, as in many instances they do not understand the objectionable qualities of certain feeds, and therefore may give things that will cause indigestion.

Rheumatism.

This is a disease that will not trouble back yard poultrymen if the house is kept dry and in sanitary condition, but if it does there is not much help for it. This disease is mentioned because it is sometimes confused with what is known as leg weakness.

Leg Weakness.

This disease must not be confused with gout or rheumatism. It usually comes on suddenly, and in many instances the birds are found in the morning on the floor unable to stand or walk, lying on their sides with feet and legs projecting, or, in other words, there is partial paralysis. In some cases only one leg is affected at first; in other respects the bird appears normal.

It flops about and tries to reach food, but when left alone, being unable to get water and sufficient feed, gradually weakens until death overtakes it. By placing affected birds in a dry coop and giving good food, especially plenty of green stuff, occasionally they will recover. If the birds do not recover in a short time they should be killed. Very little is known about the cause of this trouble.

Scaly Legs.

This is caused by a mite burrowing under the scales of the shank. The roughened surface, a whitish powdery crustation covering the shanks, is a by-product of these mites. It spreads through a flock, injuring its appearance, and if not given attention will eat into the shanks, making the bird lame or even causing blood poisoning. The shanks may become twice their normal size. If this trouble makes its appearance fill a 2 or 3 quart pail nearly full of water and pour over the top a little kerosene. Dip the shanks of the birds in this, immersing them for a moment, then withdrawing slowly. By so doing the scales will become somewhat softened and a portion of the kerosene will adhere to the shanks. Do not dip them in pure kerosene, as such treatment is too severe and may result in the loss of the birds. Another method of treatment is to soak the shanks in strong soapsuds, after which smear on a paste made of sulphur and lard. Continue treatment about twice a week until the scales disappear. By painting the roosts with disinfectant these mites will soon be destroyed.

Lice.

Lice live on the hens and do not leave their bodies during life. They breathe through little pores in their sides so are very easily destroyed by the use of dust, which smothers them by stopping up these openings. The best way to keep down lice is to have a good place for the hens to roll and dust. They fill their feathers and cover their body with dust, and on shaking themselves vigorously the lice are thrown from the body with the dust and dirt. Healthy hens delight in dusting themselves, and if the floor is covered with a few inches of sand or loam, do so freely. Many people keep hens on a bare board or cement

floor, and furnish no dusting material. If sand or loam cannot be used for the entire floor, a box 2 or 3 feet square placed in a corner of the house and filled with wood ashes, a little sand or loam will be very inviting to the hens. However, if the hens are badly infested with body lice they should be dusted with some reliable commercial powder. In applying this the hens should be held with head down, the feathers spread open and every part of the body covered with the dusting material. The feathers should be fairly well filled with it.

Mites.

Mites are very troublesome in the poultry house. They are small, and, when filled with blood, red in appearance, but when kept away from hens for some time are gray, due to the lack of blood in their bodies. They live in the cracks about the droppings board, in and under roosts, and, in many instances, get into the nest boxes. By examining closely the cracks or hiding places about the roosts they can easily be seen with the naked eye if present. A whitish powder, offal from the mites, is evidence of their presence. They do not live upon the bodies of the hens, but are nocturnal in habit and crawl from their hiding places when the hens are on the roost, and after sucking themselves full of blood return to their hiding places and wait until the next evening. They multiply very rapidly in warm weather, so weekly observations should be made. They can easily be eradicated by painting the roosts and adjacent parts with the mixture mentioned above. It should be applied freely.

Rearing Chicks.

Most back yard poultry keepers prefer to buy pullets in the fall rather than raise them. In congested districts, where the amount of space available for poultry is small and cats and dogs numerous, I am sure the people are justified in not attempting to raise chicks. This is especially true if they are compelled to be away from home a large part of the time, as chicks need considerable attention the first few weeks. On the other hand, there are sections in towns and cities more thinly populated and back yards comparatively large where chicks can and

should be raised. It is much better for most people to secure hatching eggs or baby chicks from a reliable poultryman than to keep a male for breeding purposes. (See page 25.) As early hatched chicks are the fall egg producers, it is advisable to secure those hatched from about the middle of March to the middle of April. Very early maturing stock, hatched late, may prove satisfactory. At the age of ten weeks the males will be ready for use as broilers, or can be kept for medium or large roasters. The females should be retained for egg production, except those that are stunted or undeveloped. These should be eaten. People who have adequate facilities for raising chicks find it a profitable way to secure their pullets, and the cockerels will reduce the meat bill appreciably. Space will not permit a full discussion of hatching and rearing, but the poultry department of the college will be glad to forward a bulletin on this subject upon application.

Preserving Eggs.

Various methods of preserving eggs have been tried from time to time by experiment stations as well as the United States government, and in practically every instance it was found that water glass (sodium silicate) gave the best results. Eggs preserved in this were found to be in excellent condition after six or eight months, so it is now coming into general use as an egg preservative.

As a rule stone jars are used for this purpose, but where large quantities are preserved, wooden receptacles, kegs with one head removed, or barrels sawed in two in the middle can be used. For ordinary family use the stone jars are recommended, and the size will vary to suit the convenience of the users. A 5-gallon jar will hold 15 dozen eggs, and will require from 10 to 10½ quarts of the liquid to cover them. The basement of an ordinary dwelling is a suitable place for storage. A cool room above ground may be used, provided the receptacle is tightly covered to prevent rapid evaporation.

The method of preserving is as follows: clean the jars or receptacles before using. A thorough rinsing with boiling water will aid materially in destroying molds and bacteria. Either hard or soft water may be used, and if it is not contaminated

in any way boiling is unnecessary. As a safeguard, however, it is well to boil it. Fill the jars with eggs, being careful not to break or crack them. See that all have perfect shells and are free from dirt. If it is absolutely necessary to use soiled eggs, wash them thoroughly before preserving. Fill the jars within 2 inches of the top with eggs. When the water is cool make the preserving mixture by using 1 quart of commercial water glass, which can be purchased at any drug store, to 12 quarts of water, or in that proportion. The number of quarts of water to use with 1 quart of water glass, as recommended by investigators, varies from 9 to 14, and the weaker solution is apparently as good a preservative as the stronger. The stronger the solution the fewer the chances for bacterial growth, but the greater will be the precipitate (the white, mushy material that forms) and the greater the cost also. One is perfectly safe, therefore, in using a solution of 1 to 12 or even 14.

Pour the mixture over the eggs until they are entirely covered. Those not fully immersed will spoil. Cover the receptacle as tightly as possible by placing over it a few thicknesses of paper, and over these a weighted board, unless a well-fitting cover is at hand. There are times when enough eggs are not at hand to fill the jar. In such cases the mixture can be placed in the jar and the eggs immersed day by day, or as they are gathered. The only caution in regard to this method is to have the hands perfectly clean. At times a pinkish tinge is noticed in whites of the eggs that have been preserved for some time. As this is not seen in those kept in a weak solution, it is probably due to an excess of silicate of sodium. It is perfectly harmless and should cause no alarm. Use a new solution each year.

Department Bulletin No. 2 January, 1921

The Commonwealth of Massachusetts

DEPARTMENT OF AGRICULTURE

Dr, ARTHUR W. GILBERT, Commissioner

136 STATE HOUSE, BOSTON 9

FOOD, FEEDING AND DRINKING APPLIANCES AND NESTING MATERIAL TO ATTRACT BIRDS

Revised from Department Circular No. 2. Third Edition

EDWARD HOWE FORBUSH

Chickadee feeding from the hand.

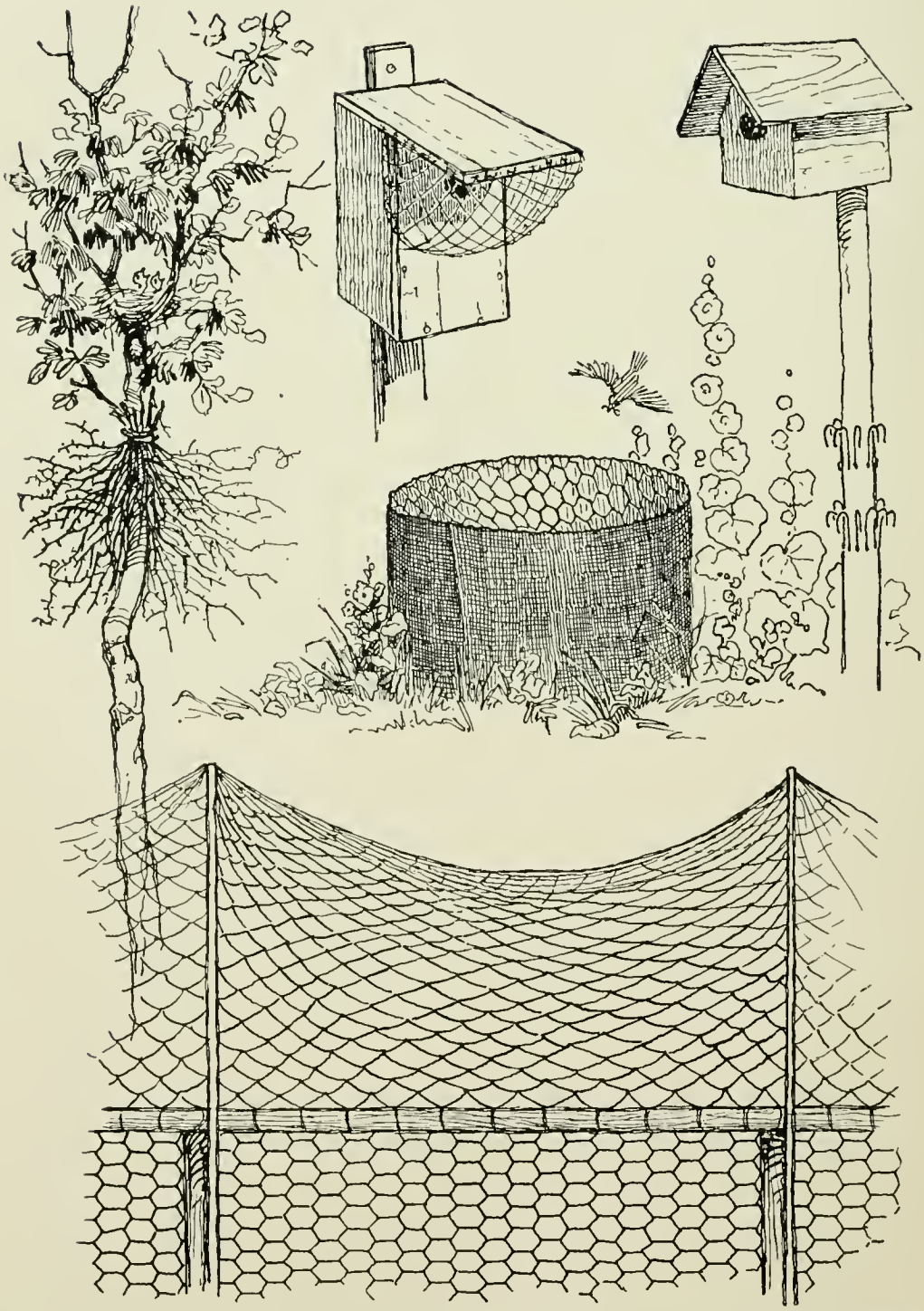


Fig. 1. — Cat-proof fence and other devices for protecting birds from cats. (From Economic Biology Bulletin No. 2, Massachusetts State Board of Agriculture, 1916.)

CONTENTS.

Food, Feeding and Drinking Appliances, and Nesting Material to Attract Birds.

EDWARD HOWE FORBUSH.

Introduction.

"Safety first" should be the motto of all who wish to attract birds about the home. Those who succeed in increasing the numbers of birds will also attract birds' enemies. House cats should be eliminated or confined. Mr. Hamilton Gibson of Sheffield was eminently successful in colonizing birds about his place, and he places the extirpation of house cats first among the measures that insure success, and says that certain "acres of melody," formerly his bird preserve, "have been converted into a barren hunting ground" by new tenants who brought cats. Dogs and cats may be kept out of any enclosure by a cat-proof fence. The only one I have known to be always successful is that shown in Fig. 1, which should be built of fine-meshed wire netting, 6 feet high, with a fish net suspended from slim poles at the top. Squirrels, particularly the red, certain hawks, crows and often jays, large snakes and all other creatures that destroy birds must be controlled. Tangles of vines and dense, thorny shrubbery should be cultivated as places of shelter and retreat for small birds when pursued by their enemies.

The first and greatest need of birds is food, of which they require great quantities. Feeding the birds is not so much a duty as a pleasure. The highest form of enjoyment lies in caring for our fellow creatures. If we feed birds we may have the pleasure of their lively company during the cold monotony of winter on the farm. Many people have so won the confidence and trust of certain winter birds that they will eat from the hand. The cut on the title page, reproduced from a photograph kindly furnished by Mr. Alexander Henderson, illustrates such

an incident. In normal seasons birds can find food somewhere, except in the stress of winter, when deep snow covers the ground and ice encases the trees; then they face starvation. Also there are exceptional times in spring and autumn when the lives of birds may be endangered in unusually cold or wet, sleety weather, when they become chilled and cannot find sufficient food. Food provided for them then may save many from starvation. When a feeding place has been established and accepted by the birds, a supply of food should be kept there throughout the year, that they may know where to find it at all times in case of a sudden scarcity. Birds will breed faster if fed well, and extra food is often a great assistance to parent birds who may come to depend on it at times while feeding their young on insects.

Location of Feeding Stations.

A feeding station for winter use should be located, if possible, in a sunny spot, on the south side of a hill, bluff, building, thicket or belt of coniferous trees, where the birds will be protected from cold winds. Food at an established feeding place will supply the birds of the neighborhood during any time of want. It will assure their presence and they will attract many others. For every minute a bird spends in eating such substitutes for its natural food as we may provide, it spends many minutes destroying insects, among them some of the greatest pests of farm and garden.

In my boyhood I observed that the skinned carcasses of small animals hung up in the shelter of the woods by trappers were utilized as food in winter by crows, jays, chickadees, nuthatches and woodpeckers, and that juncos, tree sparrows, snow buntings and other seed eaters sought food among the chaff scattered about barnyards or in farm sheds when snow lay deep on the ground. Such materials are all that are necessary to attract most winter birds, but possibly a larger number of species may be lured by using a greater variety of food, and

Fig. 2. — Hayseed scattered on the snow.

as many people are now feeding birds it is probable that those who provide the greatest diversity of favorite foods will attract the largest number and variety of birds.

Food Supplies for Feeding Stations.

Grain.

Whole grain, which can be used for human food, for farm animals or poultry, is unnecessary for feeding small birds. Little birds prefer smaller seeds, but grain may be used for feeding game birds. Broken or boiled rice, popcorn, cracked corn, hominy, rolled oats, or whole oats, rye, barley, wheat and buckwheat sometimes are used in feeding game birds or song birds. Where there are many rank weeds carrying their seeds above the level of the snow, the smaller seed-eating birds require little else. But where weeds are not allowed to grow, or where they are covered with snow, other food should be provided. Chick feed sold by poultry supply houses contains weed seeds and small or broken grains, and therefore is relished by seed-eating birds.

Seeds.

Most small seeds are eaten by birds. Weed seeds and grass seeds are favorites. Broken squash and pumpkin seeds are taken by a few species. Such seeds as those of the sunflower and hemp may be recommended for winter feeding because of the bodily warmth that they produce. Millet seed, particularly that of the Japanese, Hungarian and Golden millets, and mixed bird seed have been utilized as food for small birds. The millets can be raised in Massachusetts and a supply of seed threshed out for the birds each autumn. Mrs. Arthur Caswell says that all the sparrows like the seed of the golden millet. Mr. W. L. McAtee of the Biological Survey recommends prince's-feather, love-lies-bleeding, asters, Calandrinias, blessed thistle, tarweed, portulaca and California poppies as cultivated annual plants the seeds of which are attractive to seed-eating birds.[1] The cones of coniferous trees, such as the pine, larch and spruce, if containing seeds, may attract some species.

---

[1] United States Department of Agriculture, Farmers Bulletin No. 621.

Nuts.

Chickadees, nuthatches and many other birds are fond of nut meats. Robert Ridgway, the eminent ornithologist of the Smithsonian Institution, writing of conditions about his home in southern Illinois, where 38 species of birds winter, said that the favorite food was native nuts, including black walnuts, hickory, pecan and butternuts, in the order named, and that so long as these were provided and cracked, the birds would eat nothing else put out for them, even English walnuts and peanuts being discarded when they could get native nuts.[1] In New England the kernel of the butternut is a favorite food; unroasted peanuts are eaten by several species, and even the cocoanut is not disdained by some. Walnuts, chestnuts, beechnuts or native nuts of any kind are useful. Nuts are rather expensive food for birds, and certain acorns might be gathered in autumn, cracked, ground and substituted for nuts.

Fruit.

Dried currants, blueberries, raspberries, raisins and figs have been used to attract fruit-eating birds. Many birds eat frosted apples or crab apples in winter. Any of the wild summer fruits attractive to birds may be saved and dried for winter use, or wild fruits that remain on the stem in winter may be gathered for the food tables. (See Circular No. 13, published by the Massachusetts State Department of Agriculture.)

Animal Food.

Boiled eggs or their shells, refuse bones from the table, marrowbones cracked open so that the birds may get at the marrow, the bony framework of a cooked fowl, or the bones of a fish offer good pickings for insectivorous birds in winter. The fatty trimmings of beef, pork or mutton, pork rind, suet, lard or portions of the carcasses of animals rarely or never used for human food, such as skunks, muskrats, weasels, cats, etc., may be utilized in providing animal food in winter, when birds most need it. Cottage cheese is an excellent food that is relished more than meat or fat by some insectivorous birds. Mrs. E. O. Marshall writes that many birds show a marked preference for cheese curds.

---

[1] "Bird-Lore," Vol. XVII., No. 2, March–April, 1915, p. 102.

Vegetable Substitutes.

Vegetarians and those who object to hanging up pieces of slaughtered carcasses in view of their windows may substitute nuts, sunflower seeds, halved cocoanuts, peanut butter, mashed potato or vegetable fats for meat, bones or suet in winter.

Mixed Foods.

Mixed foods may not be necessary, but they have been used in winter with great success both in Europe and America. The idea seems to have originated with the Baron von Berlepsch of Thuringia,[1] and the formula that he uses follows: —

	Ounces.
White bread (dried and ground),	44½
Meat,	3
Hempseed,	6
Crushed hempseed,	3
Maw,	3
Poppy flour,	2½
Millet (white),	3
Oats,	1½
Dried elderberries,	1½
Sunflower seeds,	1½
Ants' eggs,	1½

To this total quantity of ingredients about one and one-half times as much of beef or mutton fat or suet is added, and the whole heated to the boiling point. Dr. Eleanor Mellen says that Hamburg steak that is easily obtained may be dried and used as one ingredient, and that if some of the others are not obtainable they may be omitted. Ground doughnuts and dog bread may be added. The mess being in a fluid state must be carried in a suitable receptacle to some dead coniferous tree. A small spruce Christmas tree is excellent for the purpose. The mixture is then ladled on the branches, care being taken to keep it stirred that the heavier ingredients may not settle to the bottom. A covered pan like a baking pan with a bale attached is useful for carrying the hot mixture. In pouring it on the

[1] Heismann, Martin: How to Attract and Protect Wild Birds. Translated into English by Emma Buchheim, 1912, p. 74.

branches one person ladles the mixture while another holds the cover underneath to catch the drippings. In cold weather the suet hardens quickly and thus both insect-eating and seed-eating birds find food provided for them in abundance in a natural situation where they must inevitably find it.

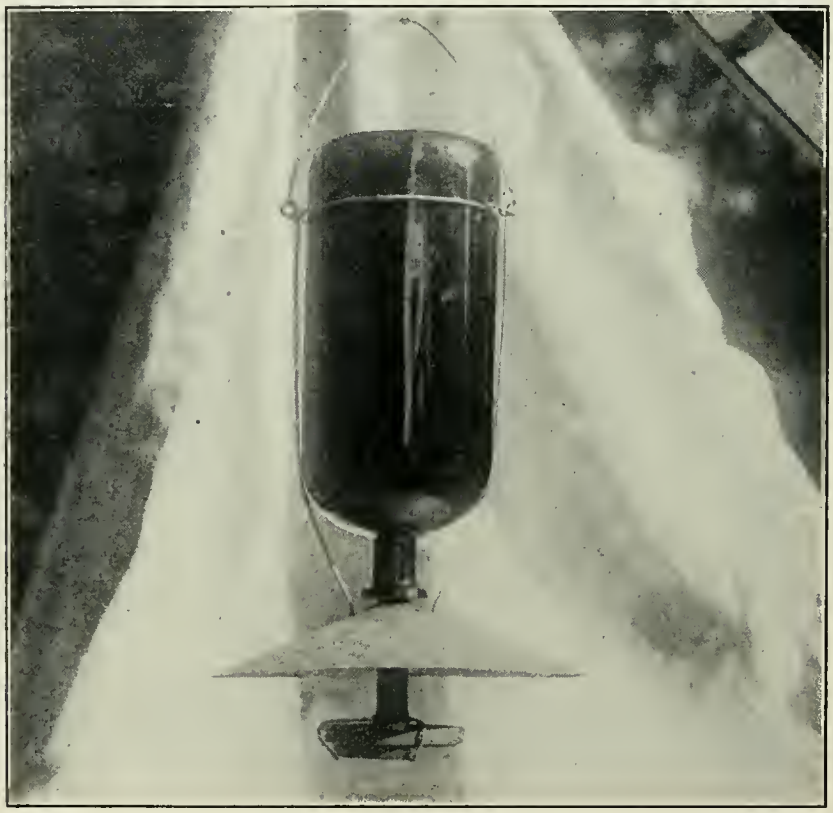


Fig. 3. — Wellesley food bell. An inexpensive and effective appliance for feeding birds with small seeds, made from a bottle, some wire, some sheet zinc and the saucer of a flower pot. (Photographed by John C. Lee.)

Miscellaneous Foods.

Crumbs and scraps from the table may be used, such as squash rinds and the skins of baked potatoes. White bread crumbs are eaten by some birds, but white bread is not a complete food and many birds will eat cake or doughnut crumbs in preference. Pumpkin pie is a favorite. Crumbs of dog biscuit form a more complete food than white bread, but some birds will not eat these crumbs. Most birds do not require salt, and too much is believed to be fatal. Few birds, except sea fowl, can drink salt water, but crossbills and certain doves and pigeons are fond of it.

Grit.

Grit of some kind to aid in digestion is as essential as food to seed-eating birds. In winter, when deep-crusted snow covers the

Fig. 4. — Wellesley receptacle for feeding birds on table scraps. This was invented by John C. Lee of Wellesley. The cover is removed at first to attract the birds, and is then replaced to keep out rain and snow; the birds then enter at openings. (Photograph by Mr. Lee.)

earth, such birds not being able to find grit may suffer much for want of it, and then we should supply it. Brands of chick-feed containing sharp grit are popular with birds in winter. Sharp sand, pounded crockery or earthenware, broken plaster, or even coal ashes may be used.

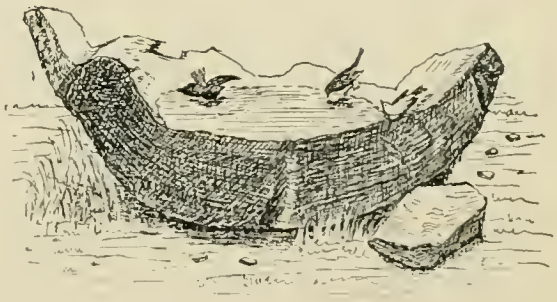


Fig. 5. — A natural hollow stone serves as a bird bath.

Water.

Water is a great attraction. Ridgway asserts that at his home, where the summers are warm and dry, the provision of water for bathing and drinking has far more to do with attract-

ing birds than anything else. Water will attract birds not only in summer but also in winter, and some people even go so far as to heat water for the birds in inclement weather, an attention which their feathered friends seem to appreciate. If a generous supply of water can be provided in summer it may be the means of saving much juicy fruit that otherwise would be eaten by birds.

Bird Baths and Drinking Fountains.

No one who has not maintained a bird bath can have any realization of its attractiveness. Drinking and bathing places for the birds are used mainly in summer. The difficulties of maintaining them in winter are manifest. The covers of earthenware jars, inverted and filled, will make excellent bird baths, as each has a low rim for a perch and the depth of the water is graduated. A milk pan set on a post high enough to be out of reach of cats, and filled with fresh water daily, or oftener if necessary, will make an excellent bird bath if a shelving stone be placed in it so that the depth of water over it will vary from one-half inch to 3 inches. A hollow in a bowlder will answer the same purpose, if the water be swept out often and the hollow refilled. Where running water is available a pipe may be carried from the house down through the cellar and underground to a standard in a flower bed on which a shallow pan (Fig. 7) may be used as a receptacle for the water. Water may be turned into the pan at any time from the tap or faucet in the house, and the water running over the rim will serve to water the plants below. There should be a vent on the pipe in the cellar through which the water may be drained off in autumn before the ground freezes. In some cases a hose is used for filling the pan. Sometimes where there is no running

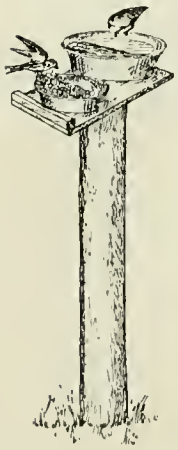


Fig. 6.—A pan of water, and one of mud for the use of birds in nest building.

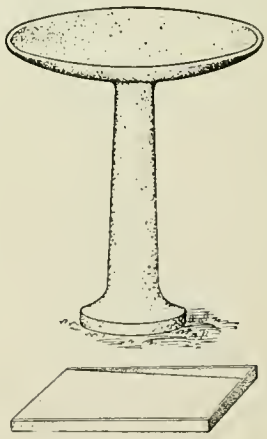


Fig. 7. — Bird baths. Upper of concrete or pottery; lower of metal. (After Biological Survey.)

water the water pipe from the refrigerator or ice chest is carried to a pan sunk in the turf, but baths set up on high

Fig. 8.

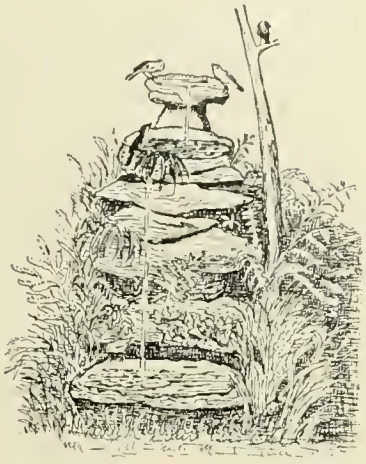


Fig. 9.

Sketches of successful bird fountains designed by Dr. C. F. Hodge.

standards where cats cannot reach them are safer. A small bird bath for little birds should be so made that, when filled, the water will not be more than $2\frac{1}{2}$ inches deep, with a gradual lessening in depth to one-half inch near the edge, and a roughened bottom to give good foothold. This will safely accommodate all little birds, but if larger birds, such as grackles and flickers, come to bathe they will wade into water at least 5 inches deep. Therefore a large bath or a pool several feet in diameter is a great attraction. This may be 5 inches deep at the center, gradually shoaling to the sides. Ornamental bird baths and fountains made of rocks and cement and surrounded by wild flowers, ferns, etc., add to the beauty

Fig. 10. — Dr. Frank M. Chapman's bird pool. (Courtesy of "Bird-Lore.")

of the home environment. Water at all drinking places should be renewed once each day in hot weather. If the receptacles are small the birds themselves may empty them oftener than

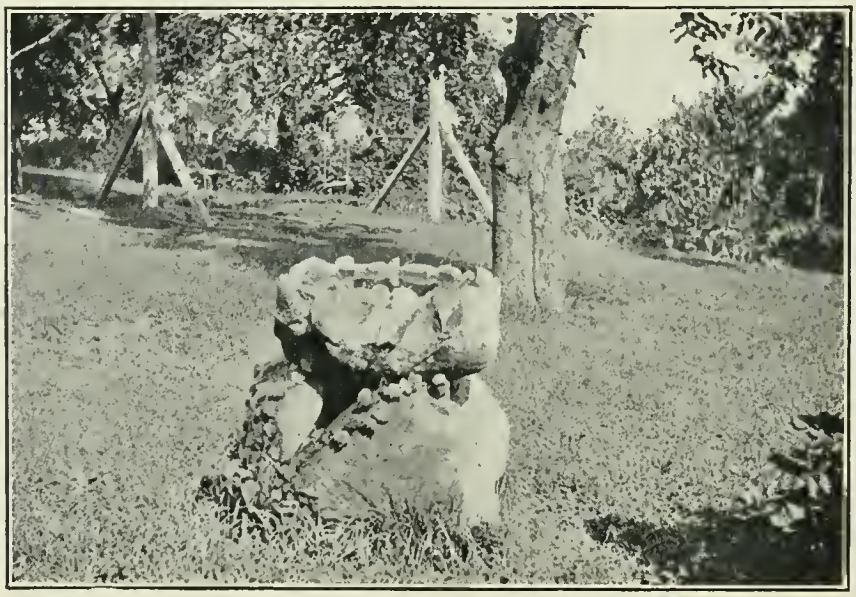


Fig. 11. — Bird bath of rocks and concrete. (Photograph by Albert C. Anderson.)

this. All containers of water should be emptied as often as once in three days in summer, to avoid establishing breeding places for mosquitoes. Place bird baths where they will be in the shade during the heat of the day, and allow no cover immediately about them to hide the approach of cats. Cats soon learn where birds come to bathe.

Fig. 12. — Suet lashed to a branch.

Appliances for Feeding Birds.

Placing Suet.

Suet, fresh beef trimmings or meat may be tied to a limb of a tree with string. The string is wound about it in such a way as to bind it on and prevent crows or jays from carrying off the whole piece or securing any large part of it at one time.

Suet Baskets. A Warning!

Suet is commonly put out for birds in wire or iron receptacles fastened to the trees. These baskets may endanger the eyes of the birds in very cold weather when the iron is full of frost. Mr. Harry J. Ladue of St. Peter, Wisconsin, found a brown creeper

caught on a wire basket. In thrusting its head in between the wires for suet one of its moist eyes accidentally came in contact with the frosty wire. Any one who has ever touched his tongue to an iron bar full of frost will appreciate what happened. The eye froze to the wire and in its struggles the bird tore out the eyeball.[1] This may be a very rare occurrence, but where it has been observed and published but once it may have occurred many times unnoted. The best suet receptacle is a crocheted bag made of twine, such as is made by Mrs. E. O. Marshall (see Fig. 15), and tacked to a small, thin piece of board, or hung from a branch by a long cord. Fine twine netting such as is used for shrimp nets or crab nets might be utilized for this purpose.

Fig. 13. — Cocoanut lunch basket. The cavity is filled with some food mixture.

Fig. 14. — A soap rack used for suet.

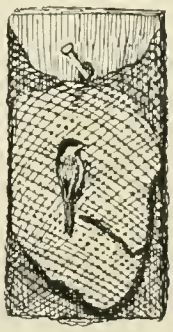


Fig. 15. — Crocheted suet bag.

Ground Feeding.

Sparrows and other ground-frequenting birds may be fed on the ground or on the snow, their normal feeding place in winter, and such feeding often becomes necessary at first to accustom them to come to food receptacles; but food thrown upon the ground is likely to be wasted, spoiled by rain or covered by snow and ice, unless under cover. Also, birds feeding on the ground are often endangered by the attacks of cats or hawks.

A Great Attraction.

There is no more popular refuge for ground birds than a heap of brush. Bushes or tree limbs may be cut and piled on the ground near the feeding places. Seed-bearing weeds may be pulled up and mixed with the brush, or the pile may be thatched with them, hayseed may be thrown into the pile, and in winter it may be roofed over with branches of pine or other

[1] Fins, Feathers and Fur. Official Bulletin of the Minnesota Game and Fish Department, No. 12, December, 1917, p. 5.

conifers, if necessary, to keep out the snow. Birds will seek it as a refuge and shelter from their enemies, and it may save the lives of many. A tight dry-goods box placed on one side so as

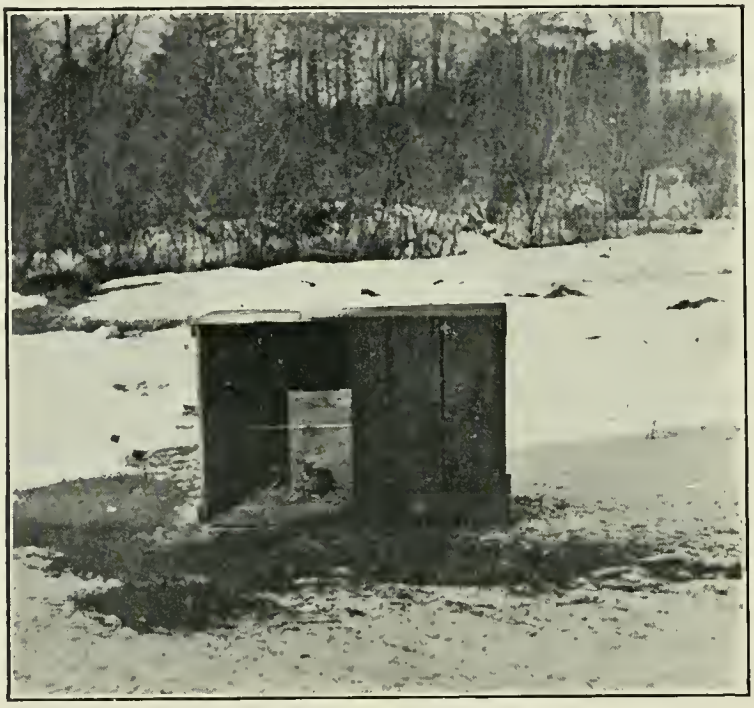


Fig. 16. — The simplest food house. A dry-goods box, with chaff and hayseed.

to open toward the south, or a scratching shed for poultry, is an ideal place for feeding such birds, for it furnishes shelter from wind and rain, and the birds can go in easily through the wire netting in front, and are then protected from cats and other enemies, which cannot pass through the netting.

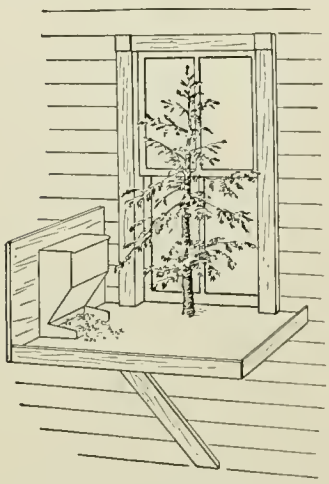


Fig. 17. —Window feeding shelf and feed hopper. (After Biological Survey.)

The Feeding Shelf.

The feeding shelf or table is useful if set at a window high enough so that dogs and cats cannot reach it. Such a shelf may be placed on the south side of a house. It may be kept clear of snow and supplied with food from inside by raising the window, and the birds may be watched at close range through a sash curtain, which conceals the watcher. If the birds do not come readily to this con-

trivance, a moving food shelf may be hung from a wire reaching to some near-by tree where the birds may be fed at first, and when they have become accustomed to this, the "trolley" shelf may be moved nearer and nearer the window shelf day by day, until they have learned to feed there, when the use of the trolley may be discontinued. If the ground birds do not come to the shelf at first, they may be fed on the ground near by, and then tolled nearer and nearer the shelf until they follow the tree birds to it. A little bush or tree set upon the shelf and supplied with food attached to the branches will give the arboreal species a chance to display their natural feeding habits, while the ground birds will feed mainly on the shelf. A food hopper may be provided, as shown in Fig. 17. Such a hopper filled with seed will feed it down as the birds want it, so long as it is kept clear of snow and ice.

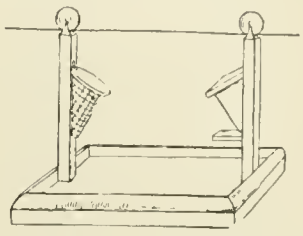


Fig. 18. — Trolley food shelf. (After Ladd.)

The Window Box.

In some respects the covered shelf or window box is an improvement on the outdoor shelf. In it the food and the birds are protected from storm and wind, and it brings the birds practically into the room. Birds soon become accustomed to it and frequent it in considerable numbers.

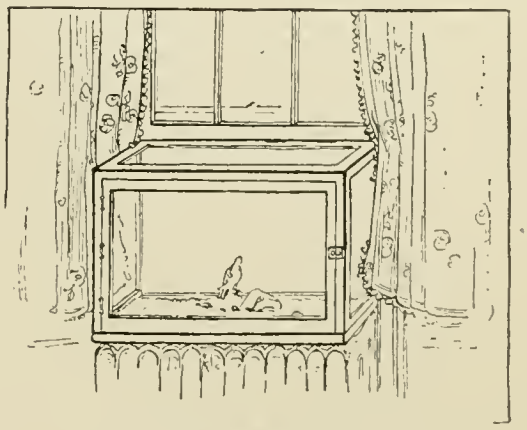


Fig. 19. — Window box.
(From "How to Attract Wild Birds about the Home." By Niel Morrow Ladd.)

The Weathervane Food House.

The weathervane food house is the most perfect device yet invented for outdoor feeding, but it should have a hopper built into the top that can be filled with seed. This hopper should be large enough to hold a month's supply of seed, and should be made to "feed down" as fast as the birds eat the food at the bottom. The weathervane food house swings with the wind and always keeps the opening away from wind and storm. The food house shown in

Fig. 20 is the best that I have tried. It is made of seven-eighths-inch cypress boards mounted on an iron rod, and revolves on an iron socket. The lower box is $18\frac{1}{2}$ inches long and 22 inches wide, with a narrow pane of glass extending across the closed front to let in light. The whole contrivance including the vanes is $36\frac{1}{2}$ inches in length at the bottom. The vanes which are bolted to the box extend $24\frac{1}{2}$ inches beyond it at the bottom and about $2\frac{1}{2}$ inches more at the top, as they are cut at an angle. They are 9 inches wide at the end. The vane and the side of the lower box might well be made in one con-

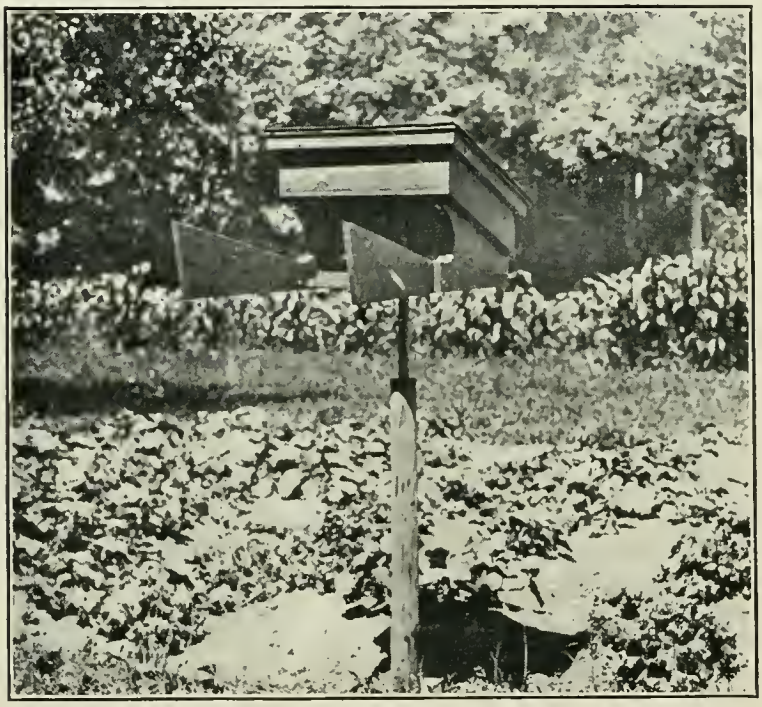


Fig. 20. — An excellent weathervane food house. The upper part contains a hopper, to be filled with seeds. (Original photograph.)

tinuous piece. The upper box is a little larger than the lower box, is nailed upon it, and the cover which overlaps it all around is covered with the best roofing felt to keep out all moisture. The floor of the upper box or hopper is covered with zinc to facilitate the sliding down of the seed which goes into two conductors, one on either side at the back. The glass extending across these enables one to see if there is food in the hopper without raising the cover, which is hinged and may be readily opened by pressing a bolt on the right side. The hopper will hold seed enough to last for weeks, and a suet rack

or bag may be suspended from one side near the open front. It may be necessary to attract the birds to it at first by putting out chaff on the ground beneath and suet on some near-by tree. A little observation will teach one how to lure the birds to it, and when they have once learned to come they will prefer it in winter to the unsheltered ground. The seed cannot blow out, snow and rain cannot blow in, and if it is so mounted that cats and squirrels cannot get in, it is as nearly perfect a feeding appliance as can be made.

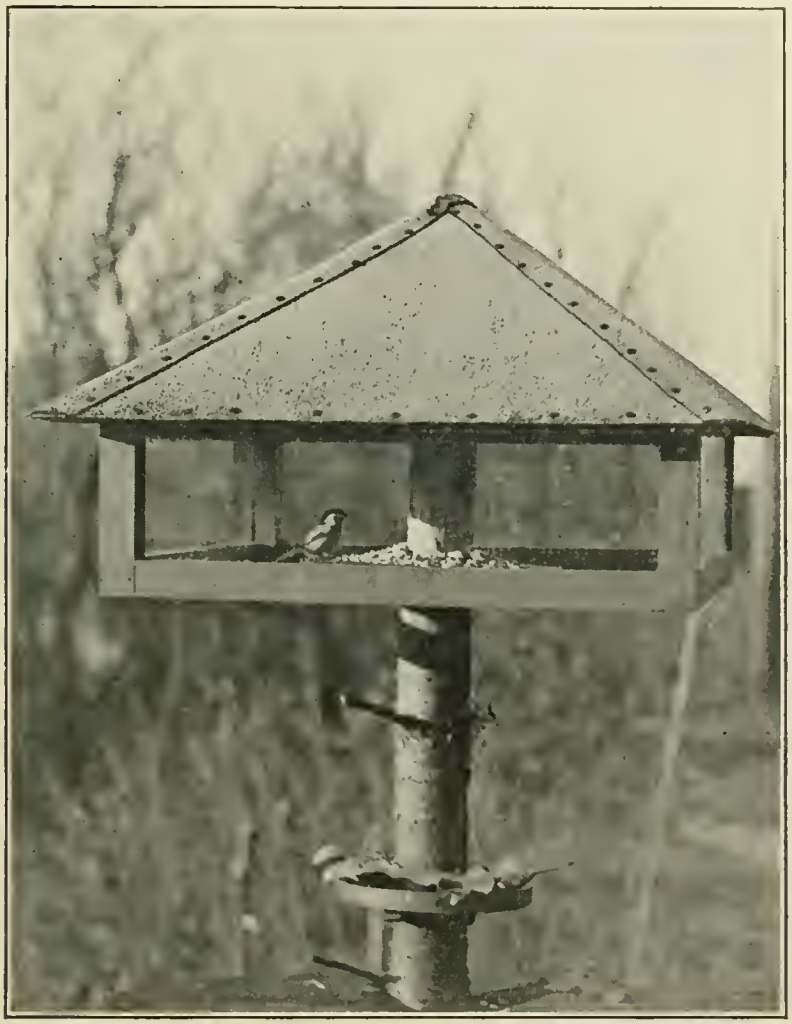


Fig. 21. — Food house used in the sanctuary of the Charlestown Bird Club, Charlestown, New Hampshire. Suet is placed in the lower tray to attract the birds until they find the upper tray, which is protected from storm. (Photograph by courtesy of Walter M. Buswell.)

Anti-Squirrel and Anti-Sparrow Devices.

Gray squirrels are so greedy that often they are not satisfied to take the food as it comes from the hopper, but gnaw away

the boards in order to get all of it at once, thus ruining the hopper. A good device to prevent squirrels from climbing to the food house would be an iron rod as a support for the house, 6 feet in height. Now and then some agile squirrel will surmount almost any contrivance that may be invented to block its passage. Then there is nothing to be done but to trap or shoot the squirrel, or to surround the supporting post with several rows of large fish-hooks, closely set, nailed, stapled or wired on with the points downward. This is said to be effective but may not be so in all cases.

Those who do not care to feed English sparrows or squirrels may try any of the following devices: two pieces of suet may be tied up with twine and connected by a piece of string about a foot long. This may be thrown over a limb or a wire, as boys throw horse-chestnuts, and if thrown with sufficient force the string will wind about its support, leaving the balls of suet hanging. Native birds will readily cling on and feed, but the sparrows find it difficult. This method is used successfully by Miss Cordelia Stanwood of Ellsworth, Maine. Miss Agnes M. Learned lashes suet to light sticks and suspends them by string, puts food in small suspended baskets that sway in the wind, and stuffs suet into cracks in the bark on the under side of willow limbs. Another successful plan is the use of the so-called food stick. (See Fig. 23.) Suet or tallow is melted, mixed with bird seed, and poured into inch auger holes made in a stick or section of a branch. When the contents of the holes have been hardened by the frost the stick is nailed or tied under the branch of a tree, with the filled holes upside down. Dr. E. W. Vietor publishes a cut of a food stick used in Prospect Park, Brooklyn, New York.[1] This stick is grooved deeply along its length, the grooves filled with fat and seeds, the stick bound around with a netting of half-inch mesh, and then wired parallel to a slender upright limb, or underneath a horizontal one. English sparrows and squirrels cannot feed readily from these

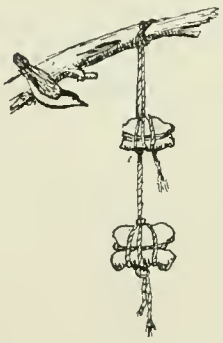


Fig. 22. — Suet hung by string.

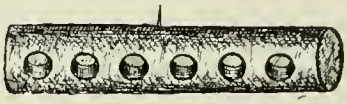


Fig. 23. — Food stick showing holes for seeds and fat.

[1] The Brooklyn Museum Quarterly, July, 1916, p. 105.

food sticks so placed. The hinged shelf for feeding birds at the window, supported at its outer edge by a light steel or brass wire rolled into the shape of a spring in the center, is said to be sparrow-proof. (See Fig. 24.) This shelf is apparently unstable and shakes when the birds alight on it. The sparrows appear to fear the motion, while native birds do not. Mr. Wm. E. Saunders of London, Ontario, pours melted tallow or fat mixed with sunflower seeds upon a flat board with a perch to which the native birds can cling, and then when the mixture has hardened fastens up the board in an inverted position. (Fig. 25.)

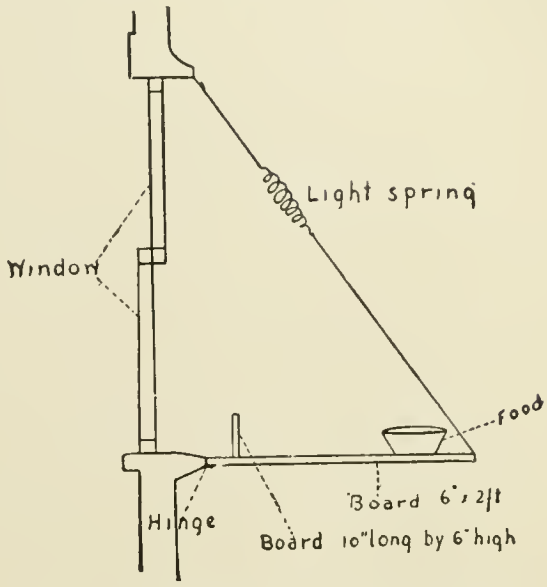


Fig. 24. — Diagram of food shelf designed to repel the English sparrow. (Courtesy of "Bird-Lore.")

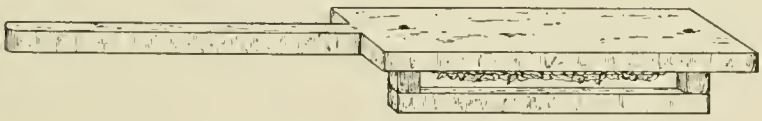


Fig. 25. — Feeding device to checkmate English sparrows. (Invented by Mr. Wm. E. Saunders.)

Methods of attracting Certain Desirable or Beautiful Birds.

Wild Fowl.

If wild fowl are to be attracted there must be a pool, lake, stream or river, or an arm of the sea. A small pond made by damming a brook will suffice. Here a few call ducks, or mallards, should be kept to decoy the wild birds. The pond may be surrounded with a fine-meshed wire fence, turned flat on the ground outside for at least 6 inches, to keep out natural enemies, and grain may be thrown into a foot or two of water where ducks or geese will readily find it and where land birds cannot get at it. It is important to use fine wire netting and cement at inlet and outlet so that large fish, turtles or minks

cannot get in. The attractiveness of the pond may be increased by propagating wild water plants, such as are described in Bulletin No. 205 of the United States Department of Agriculture, entitled "Eleven Important Wild Duck Foods," and in Bulletin No. 465 of the same department, entitled "Propagation of Wild Duck Foods." These bulletins may be obtained by writing to the Division of Publications, Department of Agriculture, Washington, District of Columbia.

Game Birds.

The chief means of attracting game birds such as ruffed grouse, bobwhites or pheasants is to feed them in winter and

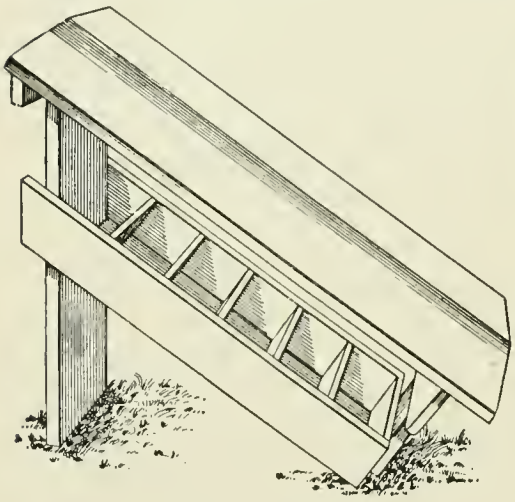


Fig. 26. — A very successful box for feeding bobwhites in winter.

Fig. 27. — Method of camouflaging the box with brush.

(Cuts by courtesy of the Massachusetts Fish and Game Protective Association.)

protect them against their enemies. Grain is the chief food used for winter feeding, and a good supply of grit is essential when the snow lies deep on the ground. The bobwhite is very fond of buckwheat. Shelters suitable for feeding most game birds are shown in Figs. 26, 27 and 30. It is well to provide food plants such as these birds prefer in summer. A list of the fruits and seeds eaten by the bobwhite is given in "Game Birds, Wild Fowl and Shore Birds," on pages 582 to 585, published by the Massachusetts State Board of Agriculture. In the same volume is given a list of the food plants of the ruffed grouse. Circular No. 13, published by the Massachusetts State Department of Agriculture, gives on page 15 some material on the

same subject. The bobwhite is fond of briar patches, weed patches, grain and buckwheat fields, mowing fields and potato fields. It likes potato beetles. It may be fed small grain or chaff in winter under brush shelters, and will generally nest where it is well treated.

Mourning Dove.

Nothing succeeds in attracting this bird like weedy grain fields and buckwheat fields.[1] About sunset the dove goes to some pool to drink and bathe, therefore a drinking place is an added attraction.

Northern Flicker.

Flickers may be attracted in summer by nesting boxes. (See Circular No. 10, Massachusetts State Department of Agriculture, entitled "Bird Houses and Nesting Boxes.") The flicker is fond of the fruit of the chokecherry or rumcherry, and the tupelo, or sour gum, as it grows on the tree. It may always be found in August and September eating the fruit of these trees. It turns to the fruit of the mountain ash, poison ivy, Virginia juniper and bayberry, or wax myrtle, in winter. In severe winter weather it sometimes comes to suet and ground raw or roasted peanuts put out for other winter birds.

Downy Woodpecker.

Suet, pork fat or meat almost always attracts this species and the hairy woodpecker. Both species sometimes eat crumbs. The downy rarely if ever nests in a nesting box, but will often sleep in one placed near a feeding station in winter.

Whippoorwill.

The whippoorwill is a very useful bird — a great destroyer of mosquitoes and other noxious nocturnal insects. It likes to sit and call on a large stone, which accounts for its propensity to alight on the door stones of farmhouses. Mr. Stanley H. Bromley tells of a farmer who provided a large tray filled with fine dry wood ashes to which the whippoorwills came at evening to dust their feathers. This suggests an interesting experiment.

---

[1] Buckwheat also attracts many other birds.

Kingbird.

This bird is desirable, as it drives hawks and crows away in the nesting season. It often nests in apple orchards, and is sometimes attracted by putting out nesting material, such as cotton batting, cotton waste, and cotton strings and yarn about a foot long hung on the branches. Kingbirds eat bees, but catch principally drones, also robber flies which are detrimental to bees. Mrs. Olivia G. Carroll found a kingbird's nest almost completely made of yarn, which she had put out for the accommodation of the birds.

Ruby-throated Hummingbird.

The hummingbirds come readily to deep flowers, columbine, bee balm, gladioli, nasturtiums, etc. They delight in the blooms of the apple and cherry trees. Miss Grace C. White asserts that these birds are extremely fond of tiger lilies. They appear to be fond of red or orange blossoms. Mrs. Doubleday recommends painted cup or Indian paintbrush, jewelweed, Oswego tea, scarlet salvia, trumpet creeper, cardinal flower, cannas, scarlet runner, fuchsias and pelargoniums; others recommend the ragged sailor, catnip and caragana. A judicious selection of the plants named above is quite sure to attract hummers. Hummingbirds have fed often from large artificial flowers with small vials of sugar and water concealed in the base of each flower.

Horned Lark.

An interesting handsome winter species, sometimes attracted by millet seed, oats or cracked corn thrown on the ground or snow.

Blue Jay.

The blue jay is quite omnivorous, and will eat meat and suet. Possibly such food provided during the spring would supply the place of the eggs and young of other birds that it is known to take. Acorns, chestnuts and corn are all acceptable, and will attract it, particularly in autumn and winter. Frozen milk is preferred to snow.

Red-winged Blackbird.

Nothing seems so attractive to this bird as oats thrown on the ground. It will find such food at any season.

Meadowlark.

This bird prefers insects to all other food, but in winter will eat small whole grain or cracked corn. When snow lies deep on the ground it comes readily to a patch of chaff thrown on the snow or even on a burlap sack, and feeds about poultry houses, picking up the scattered grain. Dr. N. Chandler Foot recommends mixed hempseed and cracked corn. Miss Evie W. Drew writes that the larks "just stuffed themselves with buckwheat and chick-feed" during the winter of 1917–18. This species is wintering more and more in New England. In summer it is fond of old fields where the grass is never cut, and nests by preference in such places.

Baltimore Oriole.

The Baltimore oriole nests in elms, but these are not essential. Worsted, wool and cotton waste for nesting material will attract it. Cotton twine, strings, yarn and horsehair cut to lengths of about 14 inches and hung out on tree branches may decide it to build its nest anywhere. Dr. N. Chandler Foot recommends worsted and wool, or cotton waste. Mrs. Olivia G. Carroll hangs in conspicuous positions a number of crocheted bags or balls, which she fills with pieces of string and cotton batting, and then draws through the interstices twine, yarn, silk floss, thread and horsehair cut in lengths of 12 to 15 inches, and left with both ends hanging out. (See Figs. 28 and 29.) Orioles and vireos seek such material often for their nests, and will build where they find it easily accessible, but Mrs. Carroll says that she has seen kingbirds, chipping sparrows, song sparrows, barn swallows, vireos, robins, goldfinches, cedar waxwings and

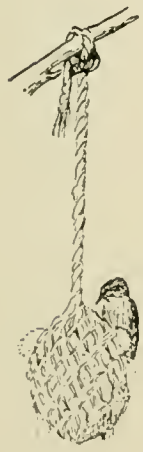


Fig. 28. — Crocheted ball filled with cotton batting for nest builders.

Fig. 29. — The same ball with yarn, string and horsehair added.

hummingbirds pulling the material from the bags. The use of bright-colored yarns seems to attract the birds, although the red yarn apparently is not so much sought after as that of other colors, and sometimes white seems to be preferred to all others; but I have seen an oriole's nest constructed of black horsehair. Nevertheless such experiments as have been recorded seem to indicate that white is preferable. The oriole loves cherries and mulberries, and sometimes when insect food is scarce will come to crumbs of bread, cake and suet. Males of this species, like those of some others, sometimes are attracted to a neighborhood where some one who can imitate their notes will take the trouble to answer their calls.

Evening Grosbeak.

This handsome bird is seen here mainly in winter and spring. In Massachusetts it seems to prefer the fruit of the ash-leaved maple, or box elder, so called, to all other food, and the suggestion has been made that the planting of these trees across the prairie States to New England has had much to do with its movement to this region in winter during recent years. Dr. A. A. Allen writes that at Ithaca, New York, the species seemed to prefer the seeds of the chokecherry. They fed on the dried cherries hanging to the trees. When the snow melted they took the cherry stones from the ground. Berries of the buckthorn, mountain ash, Virginia juniper and sumac, seeds of lilacs, maples, locusts and flowering dogwood, frosted apples, the fruit of the Japanese crab apple, and even suet crumbs and scraps thrown out are sought by this bird when the box elder seeds are gone. This species is fond of sunflower seeds, and flocks have been known to come daily to feed on this seed and to call for it until they were supplied. As spring comes buds of the red maple and other trees are eaten. A pan of water or a bird bath often attracts a flock.

Pine Grosbeak.

This fine winter species eats tree buds, also seeds, especially those of the white pine, fir, spruce, larch, ash and maple. The maple seed is a favorite, and may be gathered before snow flies for winter food. It is fond of hempseed and the fruit of the

mountain ash and honeysuckle, and eats Japanese barberries. It will also eat frozen apples. Mrs. E. O. Marshall noted that it fed on frosted apples, and she attracted several birds to the house and even to the hand by using unfrozen apples cut up so that the bird could get at the fruit from inside, as it could not readily break the skin. These unpared pieces of apple were placed on the snow near a window, but Mrs. Marshall writes that she tamed the birds and lured them into an upper window by using hemp and sunflower seeds. Hempseed seemed to be the greatest attraction, as it brought the birds to her hands. Mr. Walter P. Eaton found that they were fond of barberries which grew on a hedge, and would eat ripe apples split open so that they could get at the seed. Miss Bertha L. Brown found that both this and the evening grosbeak were attracted by the fruit of a crab apple tree that grew in her garden. Mrs. Nathan C. Squires of Fredericton, New Brunswick, noted that the pine grosbeak ate the seeds from small crab apples. The Hon. Herbert Parker notes that this bird in captivity prefers sunflower seeds beyond all else. Several observers report that in winter this species seems fond of the fruit of the high bush cranberry. Miss Eva L. Powers believes that this is eaten mainly for the seeds.

Purple Finch.

This common finch will eat dried currants, hempseed and millet seed in winter, but nothing succeeds with it like a plentiful supply of sunflower seeds. The purple finch winters even in Maine when it can get these. In winter and early spring it seeks the seeds of the white ash which still hang on the trees. Miss Evie W. Drew writes that the finches have a "perfect concert" on the ash trees in spring. Apple trees and other fruit trees are favorites, for it feeds to some extent on the blossoms. It prefers thick evergreen trees like the Virginia juniper or the spruces in which to build its nest.

Crossbills.

These handsome, curious, but erratic and irregular winter visitors eat quantities of sand whenever they can get it. Mr. Ernest Harold Baynes tells how he saw a flock of white-winged crossbills nibbling at the mortar on a ruined building in winter,

and attracted them to his yard by securing a quantity of the mortar and pulverizing it. They became so fearless as to allow one to pick them up.[1] A little salt mixed with the sand might be useful. This species sometimes feeds on weed seeds. Salt pork, pork rind, and even salt water, have been used to attract crossbills. They feed on the seeds of larches and other coniferous trees bearing rather small cones. Crossbills like the fruit of the sweet gum and Virginia juniper or red cedar, and the seeds of the Ailanthus and sunflowers.

Redpolls.

Redpolls feed much on the seeds of the gray birch during their stay with us in winter, but they are sometimes attracted by the seeds of the millet, and will come to the dooryard to get them. They will take rolled oats, hayseed and most small bird seed from any kind of a feeding box or shelf in winter, as they are quite unsuspicious.

Pine Siskin.

The pine siskin sometimes comes to chaff and hayseed thrown on the snow. Miss Eliza F. Miller tells of both siskins and redpolls eating millet seed at Bethel, Vermont, and says that this species and other birds preferred cracked butternuts to all other food.[2] In winter they seek water eagerly.

Goldfinch.

This beautiful bird is won by sunflower seeds. Winter and summer, nothing equals them as an attraction. Mr. Edward L. Parker says that goldfinches frequent the flower known as bachelor's button, and Dr. Mellen notes that chicory will call them. Dr. Anne E. Perkins asserts that the goldfinch always finds the seed of cosmos, and Miss Mabel T. Tilton places the seed of the hollyhock and that of the sweet pepper bush among its preferences. This bird is fond of the seeds of Hungarian millet, dandelions, thistles, hawkweed, goldenrod, evening primrose, hollyhock, honeysuckles, burdock, catnip, birch, locust, and the seeds of several coniferous trees.

---

[1] Baynes, Ernest Harold: Wild Bird Guests, 1915, p. 141.

[2] "Bird-Lore," Vol. XIV., November-December, 1912, p. 335.

Snow Bunting.

Millet seeds and chaff attract the lovely snow bunting, but oats and weed seeds are favorite foods.

White-throated Sparrow.

This handsome fall and spring visitor rarely winters here, but while here it is fond of crumbs and millet seed, especially that of the Japanese millet. Dr. N. Chandler Foot recommends "scratch-feed," sold by poultry supply houses. This bird feeds mainly on the ground, and will not go to food shelters on posts unless driven by extreme necessity. Mrs. N. C. Squires finds this species very fond of turnip seed, as it grows in the pod.

White-crowned Sparrow.

This striking bird is a rather uncommon visitant in spring and fall. It has been known to come to feeding stations for nuts, crumbs and seeds.

Fox Sparrow.

In times of stress the handsome fox sparrow comes to the food shelf for hayseed and Japanese millet, and two of them fed at one of my windows all winter.

Towhee.

The brush heap with surrounding shrubbery, and with chaff and seeds thrown under it, should attract all native sparrows and towhees. The towhees will take grain scattered on the ground, also crumbs and hempseed. This bird winters here very rarely, and must have thick shrubbery for cover.

Rose-breasted Grosbeak.

This beautiful bird, a singer of pure songs, follows the Colorado potato beetle, which it destroys. It loves water and a fertile potato patch, also gardens and the buds and blossoms of apple, cherry and other trees. Sometimes it may be attracted by corn or oats; berries, such as mulberries, juneberries, elderberries and wild cherries, are a great attraction; rarely it eats a little suet. Miss Harriet Abbott of Fryeburg, Maine, notes that on the occasion of a snowstorm there on May 11,

1919, a male of this species came often to suet at her window, and continued to come for about five days, during which time he ate much of the suet. It has been attracted to feeding stations by sunflower seeds in spring and autumn, and is fond of green peas, but where there are potato beetles these seem to be the chief attraction.

Indigo Bunting.

The sprightly indigo bird lives in the sprout patch and the bush pasture and nests among low bushes. It sometimes nests in brambles near the kitchen garden. It visits old apple trees in spring and feeds among the blossoms, and when the sweet corn tassels it feeds amid the corn. Dr. Foot has attracted it to feeding boxes and weathervane food houses by keeping small seeds there late in the spring. Mrs. E. O. Marshall says that it came to millet that was planted for the birds.

Scarlet Tanager.

The tanager loves apple trees and white oaks. Strings for its nest attract it if exposed near the oak trees. Miss Henrietta Greenlaw writes that a female tanager waited morning after morning until a supply of strings was put out, which it then used for nest building. In cold or wet weather in May, 1917, when insects were scarce, tanagers were fed on crumbs of cake by Hon. Edgar S. Hill. Several pairs came to the dooryard many times each day for the cake, and would eat no other food put out for them. Mrs. W. H. Herrick saw some tanagers eating a decaying apple on May 14, 1920. She put other soft apples on a leaning tree trunk and tanagers came to them.

Swallows.

Directions for attracting swallows are given on pages 13, 15 and 16 of Circular No. 10, on "Bird Houses and Nesting Boxes," published by the Massachusetts State Department of Agriculture. Mr. H. C. Denslow says that eggshells thrown out in the garden attracted swallows all summer. Mr. S. Knowlton writes that he spread over about 3 acres ashes and plaster from a house that had been burned. Numerous swallows came all summer to eat pieces of the plaster.

Purple Martin.

So far as I know no one has ever succeeded in attracting purple martins by means of food. They feed mainly on flying insects. Martin houses, such as are made by J. Warren Jacobs of Waynesburg, Pennsylvania, have been successful in Massachusetts.

Vireos.

Most vireos, especially the red-eyed and the blue-headed, may be attracted by exposing suitable nesting materials. (See under Baltimore Oriole, page 25.)

Cedar Waxwing.

Cherry, wild cherry and mulberry trees are almost certain to attract this silky-plumaged bird. Old orchards where canker-worms breed call it in May and June, and it nests in the apple trees. Like the rose-breasted grosbeak it feeds on potato beetles. Cedar waxwings have been attracted to feeding places in September by using fresh elderberries. Mr. Guy C. Allen reports that a large flock of this species fed on dried crab apples on the tree in winter. Waxwings are sometimes attracted by a plentiful supply of nesting material. Mr. H. C. Denslow speaks of bean poles, with the old vines hanging to them, as attracting birds, especially this species. From June 10 to 20, 1918, from 4 to 12 birds were busy daily in pairs, shredding off bark from the bean vines and flying direct to their nests. When cedar poles are used the bark of the poles also may be utilized by birds.

Yellow Warbler.

Several people have reported that when cotton batting has been hung upon the limbs of trees or on shrubbery, about May 15, yellow warblers have used it in building their nests. Dr. Anne E. Perkins of Collins, New York, writes that three nests of this species were built mainly of cotton that she provided for them in May, 1919.

Myrtle Warbler.

The fruit of the bayberry, or wax myrtle, is a powerful attraction for this graceful bird in winter. It has been known to eat a little suet.

Pine Warbler.

Bayberries and suet have been known to attract this yellow-breasted species, which winters rarely in southeastern Massachusetts. It is found there chiefly in pitch pines.

Mockingbird.

From the sea to the valley of the Connecticut, and more rarely in the western counties, the mockingbird appears to be a local resident in Massachusetts. The recent severe winter (1917–18) has much reduced its numbers, but if it is well fed and cared for by its many friends it should increase. So far as my investigations go, there is no evidence that mockingbirds in Massachusetts eat seeds for food purposes. They swallow many seeds in fresh or dried fruits, but digest only the outer covering or pulp, or a part of it, and regurgitate the seeds and the tougher skins. Therefore they may be fed in winter by using dried wild fruits or fruits remaining on the stem. Mr. H. H. Henderson of Wilmington, Ohio, noted that a mockingbird at the feeding table in winter ate walnuts, crumbs and suet.[1] Hard-boiled eggs, omelette and boiled rice mixed with egg are sometimes taken by this bird, and it is very fond of chopped figs. Dried elderberries, raspberries, blackberries and mulberries probably would attract it, as it is fond of these fruits. If nothing else is at hand chopped apple may be used in winter. Probably a variety of wild fruits that remain on the stem all winter would act as a strong lure to this bird, as one has wintered for several seasons at the Arnold Arboretum at Boston, where there is a diversity of fruiting shrubs and trees. The berries of the different species of holly and cornel, smilax, Virginia creeper, the black alder, juniper, sumac, buckthorn, the poison ivy, bittersweet and bayberry, and also rose hips, are sought by it in winter. In Massachusetts it has developed a great liking for the Japanese barberry, which in some localities it seems to prefer in winter to native wild fruits. Mrs. Wm. F. Eldredge says that a mockingbird seemed to prefer frosted decaying apples to any food offered. In 1918 Mr. Sidney Chase at Nantucket fed a mockingbird on figs, cut in

[1] "Bird-Lore," Vol. XIX., September–October, 1917, p. 270.

small strips, and seeded raisins. This bird also ate the fruit of the spindle tree (*Evonymus europæa.*) Mrs. Arthur Caswell reports that a mockingbird in Montague ate, in addition to raisins and figs, dried raspberries and blueberries. At the Arnold Arboretum the mockingbird feeds on small fruited Chinese, or Siberian, crab apples and privet berries.

Catbird.

The catbird winters more rarely than the mockingbird in Massachusetts, but it sometimes comes in summer to pick up crumbs of suet. Miss Mabel R. Wiggins feeds a pair of catbirds, by placing various edibles in the arbor at a back door. She has seen them eat fried and boiled fish, bread, cold mush, and boiled potato. At that season a brush heap, some tall, dense shrubbery, plenty of water to drink, and a large strawberry bed are almost sure to bring the birds. Catbirds, robins, vireos and a few other species will use strips of paper in nest building.

Brown Thrasher.

This fine songster is naturally rather shy, and prefers the back pasture to the neighborhood of the farmhouse, but a few brush heaps, some thick, thorny shrubbery, and some oats scattered about the dooryard or garden in early spring may induce him to leave his retirement and take up a residence near the house. This bird winters very rarely. Colonel John E. Thayer fed a brown thrasher during the hard winter of 1917–18, and it lived through the winter, on hempseed chiefly; sometimes it ate suet. Dr. Foot has seen the thrasher feed on bread crumbs placed in boxes on posts at Dublin, New Hampshire, where it fed crumbs to its young. Miss Wiggins saw one eat dried apple at a feeding table.

House Wren.

This vivacious little bird is attracted by nesting places in hollow apple trees or by wren boxes put up for it. A plethora of boxes is needed, as sometimes a single pair will build three or more nests. House wrens have increased much in numbers in the past few years, since the number of nesting boxes has been increased in New York and New England.

Brown Creeper.

Several observers report that in winter the creepers will eat suet. Mrs. Mary R. Stanley says that after woodpeckers and nuthatches have reduced suet to mere specks adhering to the membrane the creeper partakes of it greedily.

Nuthatches.

Winter and summer feeding of suet and sunflower seeds, squash and pumpkin seed cut or broken in halves, and the provision of nesting boxes, serve to attract both the common species. They use the boxes for sleeping places on winter nights, and as a refuge to which they flee from enemies. Some few may remain and nest in them during the summer. Peanut butter is said to be a very attractive food for nuthatches. Those who wish to experiment might try it.

Chickadee.

What is true of the nuthatches is true of the chickadee, as their habits are similar. The chickadee, like the goldfinch, takes sunflower seeds from heads left on the stalk, and sometimes finds insects in these heads after all the seeds are gone. Dr. Anne E. Perkins asserts that chickadees prefer to all else black walnuts and butternuts. Some like to pick over the skins of baked potatoes.

Hermit Thrush.

This exquisite songster is a forest bird, and lives in summer in or near the shade of pines, spruces or hemlocks. In autumn or early winter, and sometimes in early spring, it may be seen about dwellings, where it seeks the berries of the Virginia creeper or woodbine, and those of viburnum, bush honeysuckle and Japanese barberry. It sometimes takes suet or crumbs from the feeding shelf. In inclement weather it often resorts to sumac berries.

Olive-backed Thrush.

Mr. Hamilton Gibson says that many birds of this species came to feed on Ampelopsis berries at his porch in October, 1919, and to get these berries they came within 6 or 8 feet of the observers.

Robin.

In early spring robins often will take cheese curds from the ground or a flat rock, and they are fond of "smearcase," or cottage cheese. Miss Mabel Tilton says that barberries and privet berries are eaten on first arrival, and that later crumbs of suet are taken.

Mr. F. P. Shumway says that robins fairly fought one snowy morning in early spring for some elderberries that he had saved during the winter. Dr. Eleanor Mellen writes that the first robins may be brought to the house in the very early

FIG. 30.—Feeding booth for bobwhites. (Photograph by courtesy of Allen A. David.)

spring by throwing out sumac heads that have been gathered in autumn and kept in water through the winter.[1]

Robins take nesting material, even cotton batting, with avidity, and a pan of mud or clay often will attract them. Mrs. Mary R. Stanley writes that one pair of robins took more than fifty little strips of old soft cloth laid out on the grass for them. But a good garden, an old orchard, a fertile lawn and some fruiting cherry trees are all that are necessary to bring the robins flocking, especially if cats are absent.

[1] Mellen, Dr. Eleanor: Practical Methods for attracting Wild Birds, 1915, p. 11.

Bluebird.

A few nesting boxes and a row of stakes about 5 feet high and 3 rods apart, driven across an open grass field or meadow, make homes and watch towers for the warbling bluebird, from which it makes short sallies into the grass for insect pests. Professor C. F. Hodge taught bluebirds to come into his study by feeding them meal worms. In autumn they are attracted to dwellings by berries of the Virginia creeper, or woodbine, and those of the matrimony vine. Bluebirds are learning to eat Japanese barberries in early spring. Mrs. Mary R. Stanley reports that some at that season ate very small crumbs of suet from an old rug spread on the ground, and readily found such crumbs when placed in a box similar to a nesting box fastened on a tree. They would not eat larger crumbs, such as robins swallow.

Publication of this Document approved by the Supervisor of Administration.

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 3

November, 1918

REPORT OF THE ENTOMOLOGIST FOR 1918

H. T. FERNALD

From the First Annual Report of the Massachusetts State Department of Agriculture

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

1-19-200

REPORT OF THE ENTOMOLOGIST.

H. T. FERNALD, PH.D.

But three official reports on entomology in Massachusetts appear to have been published in the history of the Commonwealth. Dr. T. W. Harris, as a member of a scientific commission appointed by the State for a geological and botanical survey, prepared a "Report on Insects Injurious to Vegetation," which was published in 1841, in a revised form in 1852, and as a third edition, revised by Secretary Charles L. Flint, in 1862. Though this work by the father of economic entomology will always remain a monument to the memory of its author and an honor to the State which authorized it, it cannot be placed in the class of reports.

In the seventeenth annual report of the secretary of the Board of Agriculture for 1869 is an essay by Dr. A. S. Packard on "New or Little Known Injurious Insects," followed in the eighteenth report of the secretary by a "First Report on the Injurious and Beneficial Insects of the State of Massachusetts," Dr. Packard having been elected entomologist to the Board in August, 1870. A second and third of these reports followed, but for some reason they were discontinued. There have been later entomologists to the Board, but for the most part the position has been regarded as merely an honorary one and no reports have been published.

Massachusetts accordingly has nothing to show in the way of a series of reports on the insects of the State from year to year, — nothing to correspond to the long series coming from Illinois, New York, New Jersey, Connecticut and many other States, — a condition much to be regretted, as such a series would now be almost invaluable if it were in existence. Even a record of insect conditions each year, carefully worked up, would be of great use, and such a record for the year 1918 is therefore presented here.

Insects of the Year 1918.

Insect conditions appear to be closely correlated with weather conditions in many cases. The severe winter of 1917–18 apparently had considerable effect on the San José scale (*Aspidiotus perniciosus* Comst.), destroying more than the usual number of these insects and so checking them that few complaints of their injury were received last summer. The parasite of this insect (*Prospaltella perniciosi* Tower), first discovered at Amherst, and which for a time killed up to 90 per cent of the scales in some places, has become less effective, and as the other parasites do not appear to have increased in abundance, the decreased importance of the scale this past season can in all probability be considered as due at least largely to the winter.

The most serious feature of the insect situation in Massachusetts during 1918 is probably the continued activity and spread of the European corn borer (*Pyrausta nubilalis* Hbn.). This insect was discovered in the fall of 1917 in many places near Boston, tunneling in corn and other plants. It is widely distributed in Europe, where it feeds on corn, hops, hemp, millet and several kinds of grasses, and if it should spread to the "corn belt" in the United States would undoubtedly cause enormous loss.

The European corn borer is now present over more than 135 square miles of territory, mainly west and north of Boston. Numerous reports of its presence elsewhere in the State have been investigated, but the trouble in every case thus far has been due to the common stalk borer (*Papaipema nitela* Guen.). Sweet corn is practically the only kind of corn grown within the area thus far infested, but this is seriously injured. The early crop in one field in 1917 was damaged fully 20 per cent, while with the late crop the loss in at least one case that year ran as high as 80 per cent.

The insect bores in the stem of the corn, and some beginning at the internode bearing the tassel weaken this so that it breaks over. Often the stalk bearing the ear is bored into and many of the caterpillars enter the ear directly from outside, ruining it for food.

Treatment for this pest must be by a destruction of the stalks, either by burning, burying deeply or by feeding to stock. Ensilage should prove effectual. Unfortunately the insect bores in barnyard grass, pigweed and other weeds also, so that destruction of the corn stalks will fail as an entire protection.

The Federal Horticultural Board has placed a quarantine on all shipments of corn, except shelled corn, from within the present known infested area to other States. A similar action preventing shipping from within the infested area to all other parts of Massachusetts is extremely desirable in order to prevent the establishment of colonies of this pest elsewhere in the State.

During the spring and early summer the plum curculio (*Conotrachelus nenuphar* Herbst.) caused considerable injury to plums and also to apples, and in several places the work of the red bugs (*Heterocordylus malinus* Reut. and *Lygidea mendax* Reut.) was quite serious. These last-named insects as pests are rather new in Massachusetts, but have appeared in gradually increasing numbers during the last five years.

In southeastern Massachusetts, particularly in the more sandy localities, the rose bug or rose chafer (*Macrodactylus subspinosus* Fab.) was unusually abundant on grapes, roses and other plants, and everywhere it was quite in evidence. On the contrary, the elm-leaf beetle (*Galleruccella luteola* Mull.), which has been almost entirely lacking in the State for several years now, was again so nearly absent as to render spraying for it unnecessary.

The apple tree tent-caterpillar (*Malacosoma americana* Fab.) is another insect from which the State was practically free in 1918, except to a slight extent in southeastern Massachusetts. This pest for a number of years was extremely abundant, reaching its climax in the western part of the State in 1913 and 1914, and in the eastern part about a year later.

The European war has led to a great increase in the number of gardens in Massachusetts, and with an unusual amount of food supply insects injurious to vegetables have been much in evidence. In June flea beetles (*Haltica* spp.) caused considerable injury to potatoes, tomatoes and beans, and early

in August they resumed their work to some extent. Cucumber beetles (*Diabrotica vittata* Fab.) were also plenty and did much damage. The Colorado potato beetle (*Leptinotarsa decimlineata* Say), though abundant in some parts of the State, was not serious in general, but the three-lined potato beetle (*Lema trilineata* Oliv.), which is rarely noticed in most years, was unusually plentiful.

In 1917 the potato plant louse (*Macrosiphum solanifolii* Ashm.) was extremely abundant, and in many parts of the State caused much loss. This year it reappeared about ten days earlier than last year, and its work was practically at an end early in August. It was very abundant in many places, though frequently of two fields quite near, one would be nearly destroyed while the other was practically untouched. Parasites were generally numerous and rendered good service.

About the first of August reports began to arrive of the defoliation of beech, maple and other trees in western Massachusetts, and an investigation was made. The insect concerned proved to be the Saddled Prominent (*Heterocampa guttivitta* Walker), which had been very abundant over much of the same territory the previous year. From reports received and visits made, the work of this insect appears to have extended about as far north as Brattleboro, Vermont, and to have extended southward through the hill towns of Franklin and Hampshire counties west of the Connecticut River about as far as Chester and Becket, and was also in evidence in a few of the towns in the eastern part of Berkshire County. It was very noticeable that the defoliation was almost exclusively on the hilltops, the valleys being practically untouched, while thousands of acres of woodland on the higher elevations were entirely stripped.

Beech and maple appeared to be the preferred food plants, but others were eaten where these species failed to furnish sufficient food for the caterpillars, and in many places only evergreens and the moosewood (*Acer pennsylvanicum* L.) retained any foliage. These, however, were absolutely untouched, no matter how famished the caterpillars were. In several cases apple orchards near woodlots where the caterpillars were abundant were also attacked and stripped.

By the 6th of August the work of these insects had reached its climax, and many had left the trees and were entering the ground to pupate. On the base of one tree where the caterpillars were rather more abundant than usual, 81 were counted in a space à foot square; and while this was more than the average for such locations, it was by no means the densest congregation of the caterpillars which was observed.

Enemies of the insect were abundant and actively attacked the caterpillars. The predaceous beetle (*Calosoma frigidum* Kirby) and the bug (*Podisus modestus* Dall.) were both seen feeding on the larvæ, and numerous parasitic flies were actively buzzing around them, but were not observed in the process of actual attack.

Many trees appeared to be dead, and while it is probable that some will recover, others are probably lost. Where trees were stripped in 1917 they were undoubtedly in a weakened condition when the severe winter followed, and these two factors together may have left them unable to live longer. Others which survived and were stripped again this year may now find this to be more than they can resist and may die also. Certainly in some of the "sugar bushes," the loss of trees will be quite heavy, particularly with those which have passed their prime, but, as a whole, the loss of a large part of the beeches and maples in the infested territory is not probable.

Whether the Saddled Prominent will reappear in 1919 cannot now be foretold. In Maine a somewhat similar outbreak lasted three years, though it was less serious the third summer, and the fourth year hardly a specimen of the insect could be found. From the abundance of enemies of the Prominent observed this year, the prospect for at least a reduction in its numbers next summer would appear probable.

The striped maple worm (*Anisota rubicunda* Fab.) was quite abundant along with the Saddled Prominent in many places, but hardly ranked as a serious pest.

About the last of July the cabbage butterfly (*Pontia rapæ* L.) was extremely abundant, and in September its caterpillars — the green cabbage worms — were more numerous than the writer has ever before observed them in Massachusetts. If

winter conditions are successfully met by these insects, we may expect them to be a serious pest next year, as few of them this fall appeared to be parasitized.

Another unusually abundant insect this year was the squash-vine borer (*Melittia satyriniformis* Hbn.), whose work became evident early in August. In one field seen by the writer, only 4 plants out of about 400 survived, and half a dozen or more larvæ were often found in a single plant.

During August in western Massachusetts the fall web-worm (*Hyphantria cunea* Drury) was unusually abundant, its webs being noticeable everywhere. This insect has not been much in evidence before this year for some time.

The house fly (*Musca domestica* L.), always abundant by September, became so early in August this year, and has appeared to be present in larger numbers than usual.

Insecticides, following other war conditions, have increased in price, and in many cases have been difficult to obtain when needed. It would seem wise to watch the markets during the present winter and take advantage of any marked reduction, in order to lay in a supply for next season.

The Commonwealth of Massachusetts
STATE DEPARTMENT OF AGRICULTURE
WILFRID WHEELER, *Commissioner*

DEPARTMENT CIRCULAR No. 4
February, 1919

THE ENGLISH SPARROW AND SOME MEANS OF CONTROLLING IT

EDWARD HOWE FORBUSH

The house sparrow, or English sparrow (*Passer domesticus*), male and female

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

2-18-2000

THE ENGLISH SPARROW AND SOME MEANS OF CONTROLLING IT.[1]

EDWARD HOWE FORBUSH, STATE ORNITHOLOGIST.

Introduction.

All our native sparrows are beneficial birds and should be protected. Care should be used not to disturb, molest or destroy any native sparrow or to confuse any with the imported sparrow which is the subject of this paper. The name English sparrow is a misnomer, as the bird referred to is the "house sparrow" (*Passer domesticus*) of Europe, where it is native to nearly the entire continent, but the former name has been adopted in the United States and will be perpetuated. The so-called English sparrow, regarded by most competent authorities as a pest in the United States, is more injurious and less beneficial than most native American birds, but nevertheless has many friends in this country. It has beneficial habits, for practically all land birds destroy pests of some kind. Few people may now remember that this sparrow on its introduction to America was recommended for the special purpose of ridding park trees of geometrid caterpillars, a service which it undoubtedly performs. Native birds, however, might have done as well or better had the sparrow been left in its original home, and had they been encouraged to nest in the parks, for practically all small birds eat such insects.

Is the Sparrow a Pest?

Many people have complained to me that the sparrow has driven other birds from nesting boxes and has dragged the young of other birds out of nests and killed them. Where there are English sparrows it is useless to put up nesting boxes or bird houses for native birds unless some effort is made to

[1] This circular is substantially identical with Circular No. 48 of the Massachusetts State Board of Agriculture, which is now out of print. In its present form it has been revised and brought up to date.

control this foreign enemy; otherwise the boxes eventually will be occupied by sparrows, other birds will be driven out and the net result will be an increased sparrow population. A great manufacturing firm writes: —

> The sparrows have become so numerous about our buildings as to be almost unbearable so far as noise is concerned. Also they are extremely dirty, and we are very desirous of keeping them away. It has occurred to us that poisoned food of some sort could be used with safety. May we not hear a word from you? If poison is proper, how shall we proceed?

Many inquiries similar to the above have been received. Most of these inquirers have been referred to Farmers' Bulletin 383, by Ned Dearborn, published by the Bureau of Biological Survey, United States Department of Agriculture, on "How to destroy English Sparrows," and Farmers' Bulletin 493, issued by the same Bureau, entitled, "The English Sparrow as a Pest," by the same author; but so many complaints continually come in and so many requests for methods of destroying the sparrow have been received, that at last it has become necessary in self-defense to publish a circular in reply to these complaints, giving the desired information.

The old-time question as to whether the sparrow is a pest or not continually comes up. The sparrow rears many young, and as the young are fed to some extent on insects they consume quantities of insects in a summer. Were the sparrows in our city parks destroyed, probably we should have serious trouble with certain leaf-eating insects before native birds could be attracted to these parks in any numbers, but few native birds can nest in the parks while the sparrow remains. The sparrow consumes quantities of army worms, and becomes a useful bird whenever an invasion of these insects occurs. Some people believe that since the replacement of the horse by the motor the sparrow has given more attention to insect pests because of a lack of its common food in the streets, and that it is especially beneficial now in the cities.

The greatest injury resulting from the introduction of the sparrow is the displacement of native birds and the consequent increase of injurious insects which the sparrow does not eat. The leopard moth, for example, which was introduced into this country in the latter part of the last century, has become very

destructive where sparrows are most numerous. The control of this insect is difficult and expensive, as it is a borer, remaining most of the time within the wood. Apparently the sparrows do not disturb it, and where they are numerous and native birds are, therefore, scarce, this moth is very injurious, particularly in and around Boston, New York and other large cities. When the moth spreads out into the country, where woodpeckers and other native birds are numerous, it has, thus far, made no headway. Woodpeckers dig into the burrows where the larva hides, and other birds catch it when it leaves its burrow and crawls about on the bark. Had we kept out the sparrow and instead encouraged and attracted other birds into our cities we might have been spared the destruction of many shade trees by the leopard moth.

The sparrow, however, has many friends who seem to believe that it does only good and no harm whatever. To those who see only one side of the case the various publications on the sparrow are recommended, several volumes of which have been published. Chief among these is Bulletin No. 1 of the Division of Economic Ornithology and Mammalogy of the United States Department of Agriculture, by Walter B. Barrows, entitled the "English Sparrow in North America," a report of more than 400 pages. In this bulletin, which was regarded at the time as "the most important treatise ever published upon the economic relations of any bird," evidence regarding the habits and destructiveness of the sparrow was brought together from all parts of the United States and from Europe, Australia and New Zealand. The testimony against the sparrow from all these countries is overwhelming. Two other works devoted entirely to this species had been published previously in the United States, one in 1878 by T. G. Gentry, entitled "The House Sparrow at Home and Abroad," the other in 1879 by Dr. Elliot Coues, on "The Present Status of Passer domesticus in America, with Special Reference to the Western States and Territories." Since Bulletin No. 1, referred to above, was published other investigations of the sparrow have been made by scientists, and all have resulted unfavorably to the bird, notwithstanding the fact that it devours cotton boll weevils, brown-tail moths and other pests. Baron von Berlepsch, who has established the most successful European experiment sta-

tion for the protection of birds, conserves practically all small land birds, but finds it necessary to destroy this sparrow in order to give the other birds a chance. The tremendous destruction to grain in the fields caused by this sparrow in grain-growing regions, its cost to poultrymen, its injuries to fruit and garden crops are well known. Where it has become too numerous it has destroyed quantites of fruit, including grapes, cherries, strawberries, raspberries, currants, blackberries, peaches, apples, pears, plums, tomatoes, apricots and figs. Young plants, including peas, beans, cabbage, lettuce, radishes, corn and other vegetables, are torn to pieces or eaten to the ground. Garden seeds, including those of many vegetables and flowers, are dug up when planted or eaten from the stalk. There are few garden fruits or vegetables that do not suffer more or less from the attacks of this bird. Buds and blossoms of numerous plants are destroyed by it. Its filthy habits, which injure buildings, vegetation and clothing, constitute a minor annoyance, but its chief fault, as indicated above, is the molestation and destruction in the breeding season of harmless native birds of far more value to agriculture than itself. It is not necessary to repeat here the overwhelming testimony in regard to this that may be found in any of the three volumes hereinbefore cited. My own experience is convincing. During the last forty years I have seen it drive out the great flocks of snow buntings that once fed freely in city streets, and evict all species that nest in bird houses. Where it once gets a foothold in the bird houses it drives out all other bird tenants in the end. It destroys their nests, eggs and young, and it has been known to destroy wantonly the eggs, nests and young of many birds that do not nest in boxes. It appropriates the nests of swallows, robins, warblers and other birds, and has driven out swallows, martins and wrens from large areas. The cliff swallows or eaves swallows and house wrens formerly common in many parts of Massachusetts are rare now in a large part of the State, and this can be attributed directly to persecution by the sparrow. What has happened in Massachusetts has occurred over large sections in other States. In warmer regions than this, where the winters are not so severe as here, and the sparrows increase rapidly in numbers, the effect of their presence on native species is even more

marked. Mr. Robert Ridgway, the eminent ornithologist of the Smithsonian Institution, has this to say of the sparrow in southern Illinois: —

The amazing increase of the so-called English sparrow has profoundly disturbed the "balance" of bird life. Although introduced less than forty years ago this species is now, without question, by far the most numerous bird in the region of which I write, even if it does not exceed in numbers *all* the native small passerine birds combined, not only in the towns but on the farms as well. The effect on native birds is exceedingly well marked, for the foreign pest has literally crowded out, or by its aggressive meddlesomeness driven away, from the abodes of man those charming and useful native birds, the bluebird, purple martin, barn swallow and cliff swallow. None of the native species likes its company, and, in winter, when one wishes to feed the cardinals, Juncos and other native birds, it is necessary to feed many times as many of those pernicious pests, thus vastly increasing both the trouble and the expense.

He gives details regarding the following species: —

Cliff Swallow (*Petrochelidon lunifrons*). — Formerly abundant, large colonies attaching their retort-shaped nests underneath overhanging eaves of barns, warehouses and other large buildings, but apparently has wholly disappeared.

Barn Swallow (*Hirundo erythrogastra*). — Almost totally expelled by the sparrow, great numbers of which have appropriated every nesting site in the barns and other outbuildings.

Purple Martin (*Progne subis*). — Mostly driven from towns and farms by the sparrow, the large trees containing cavities that are left being too few in number to accommodate more than a small percentage of the number that formerly occurred.

Bluebird (*Sialia sialis*). — This also has been mainly displaced by the sparrow, which has appropriated nearly all cavities suitable for nesting places.

After due consideration the question, is the sparrow a pest, may be answered as follows: Yes; but in the cities, and under exceptional circumstances in the country, it may be more beneficial than harmful.

Means of driving out Sparrows.

For the benefit of those who wish to control sparrows about their own homes some of the more common devices for ousting these birds are given below, some of which have been published in the excellent bulletins of the Biological Survey.

Many people wish to rid their premises of sparrows or to drive them out of bird houses, but not to kill them. It is practically impossible to drive them from any premises without continuous persecution, but they may be evicted from bird houses by systematic work without killing any. Various plans have been recommended, such as putting up nesting boxes without perches or with entrance holes in the bottom, providing a great plethora of nesting boxes, or suspending them by wires. None of these expedients is of any permanent value except possibly the last, and that has not been uniformly successful.

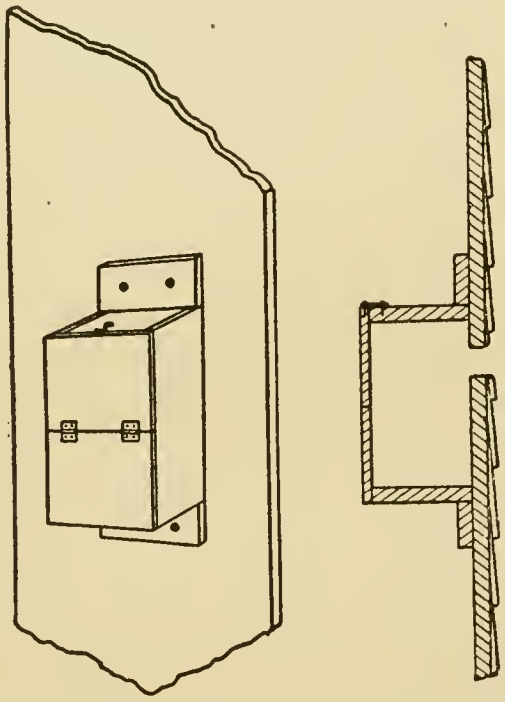


Fig. 1. — Perspective and sectional drawings of an improvised nest box for the interior of buildings. (After Biological Survey.)

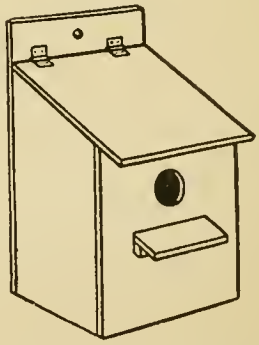


Fig. 2. — Nest box opening at the top. (After Biological Survey.)

Where this happens the boxes intended for native birds may be so arranged that the sparrows may be kept out, entrapped or driven out. A box having an entrance not over seven-eighths of an inch in diameter will admit house wrens and keep out sparrows; chickadees have been known very rarely to nest in a box with a round entrance one inch in diameter, and this usually keeps out sparrows, but if the entrance is large enough for any bird larger than the house wren the sparrow may get in. As sparrows begin nesting earlier in the spring than most other birds they may be driven from a nesting box

early in the year by removing the nesting material from the box several times a week. For this purpose a plethora of boxes must be used and each box must be easily accessible and must have an opening by means of which the nest may be taken out with little trouble. Fig. 1 shows how such a box may be attached to the inner wall of a barn or other building, where it may be quickly opened from within the building and the nesting material removed; or boxes having hinged projecting covers which will shut out rain may be put up on poles or trees. (Fig. 2.) In my own experience success has followed the practice of removing the eggs from the nests after the full set has been deposited in each case, and continuing this at intervals of fifteen days. When the nest is removed the sparrows usually begin to rebuild immediately, but when the eggs are taken, after incubation begins, the birds soon become discouraged, and when they leave the nest should be removed, after which native birds may occupy the box. A stream of water from the garden hose is very effective in evicting sparrows under some circumstances. If used on cold or frosty nights, after the sparrows have retired, it will drive them from their nests or roosting places in bird houses, or on vine-clad walls, where they constitute a nuisance. If one application is not enough it may be repeated at intervals of a few days. In wet weather, when fireworks can be used with safety, small Roman candles are recommended as an effective form of night bombardment. Sparrows do not appreciate fireworks. If some of the sparrows are killed or captured when they are disturbed this persecution will have a more permanent effect.

Trapping Sparrows.

There are many contrivances for catching sparrows on the nest, some of which are given in the bulletins of the Biological Survey hereinbefore cited, but a deep hoop net on the end of a pole may be used to catch them by placing it over the entrance of the nesting box and driving the sparrow into it. Mr. Ernest Thompson Seton fastens a flat lever on the outside of a nesting box by fixing a nail or screw in the center, so that when a string attached to its outer end is pulled the inner end rises and closes the entrance hole, thus entrapping the nesting

sparrow. He asserts that after a few have been caught in such a box others will not go in, but native birds will use it.

There are successful devices for trapping sparrows also, which are illustrated in Farmers' Bulletins 383 and 493. One of the simplest of these is the wire funnel trap perfected by Dr. A. K. Fisher of the Biological Survey. Fig. 3 shows the trap and

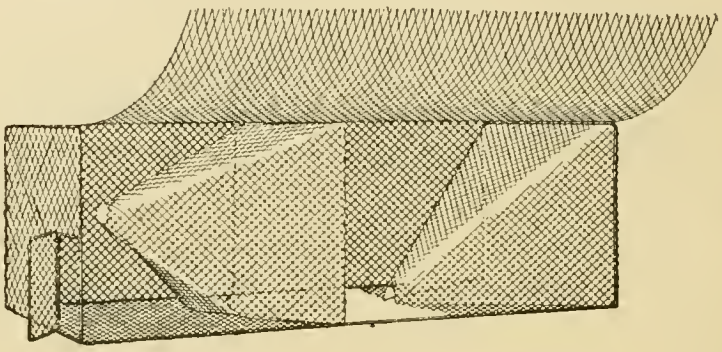


Fig. 3. — Funnel trap. Side raised to show interior. (After Biological Survey.)

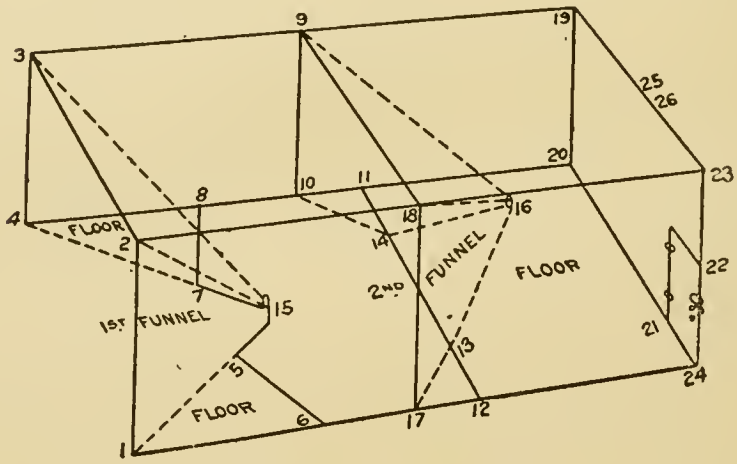


Fig. 4. — Outline of funnel trap. (After Biological Survey.)

Figs. 4, 5 and 6 give details of construction. This trap is easy to make and the cost of material is small. It has been tested on the agricultural grounds at Washington and also in the Missouri Botanical Gardens at St. Louis, and has caught hundreds of sparrows in a few weeks.

The following directions for making this trap are taken from Farmers' Bulletin 493: —

The essential parts of this trap are: (1) a half funnel leading into (2) an antechamber, which ends in (3) a complete funnel leading into (4) a final chamber. It is made of woven wire poultry netting of three-fourths inch mesh, and is re-enforced around the open end and along

the sides at the bottom by No. 8 or No. 10 wire, which is used also around the aperture for the door and around the door itself. The angles between the first funnel and the walls of the antechamber are floored with netting and the final chamber is floored with the same material. The accompanying drawings will enable anybody handy with tools to construct one of these traps in a few hours. These plans are for a trap 3 feet long, a foot and a half wide, and a foot high. At ordinary retail prices the cost of material will be about 70 cents.[1] Paper patterns for the two funnels can be made by first drawing the concentric circles, as shown in Figs. 5 and 6, and then laying off the straight lines, beginning with the longest. The wavy outlines indicate that the pattern is to be cut half an inch

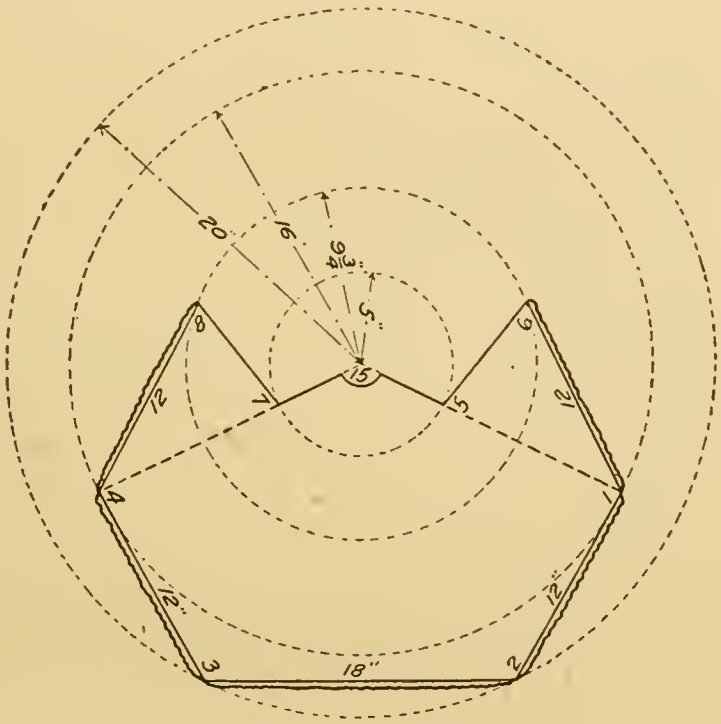


Fig. 5. — Pattern for first funnel of a trap to be 36 by 18 by 12 inches. (After Biological Survey.)

outside of the straight lines to allow extra wire for fastening the cones to the top and sides of the trap. Fig. 7 shows how all the parts of a trap having the above dimensions may be cut from a piece of netting 4 feet wide and 6 feet long. The full lines in this figure indicate where the netting is to be cut and the broken lines where it is to be bent. The numbers at the angles in Figs. 5, 6 and 7 correspond with those in Fig. 4, which shows in outline the relation of the different parts as they appear when assembled. A trap of the above dimensions is as small as can be used satisfactorily. Where sparrows are very numerous a larger size is recommended. Fig. 8 shows how a trap 4 feet long, 2 feet wide, and 15 inches high may be made from a piece of netting 4 by 10 feet. This is a very good size for parks and large private grounds.

[1] The cost of material is now (1919) much increased.

In setting a funnel trap a place should be selected where sparrows are accustomed to assemble. Often there are several such places in a neighborhood, in which case it is advisable to move the trap daily from one of them to another, because the birds appear to associate the locality rather than the trap with the distress of their imprisoned comrades. Canary seed, hemp seed, wheat, oats and bread crumbs are excellent baits. The bait should be scattered in the antechamber and first funnel, and also, sparingly, outside about the entrance. A live sparrow kept in the trap as a decoy will facilitate a catch. In case native birds enter a trap they may be released without harm. Trapping may begin at any time after

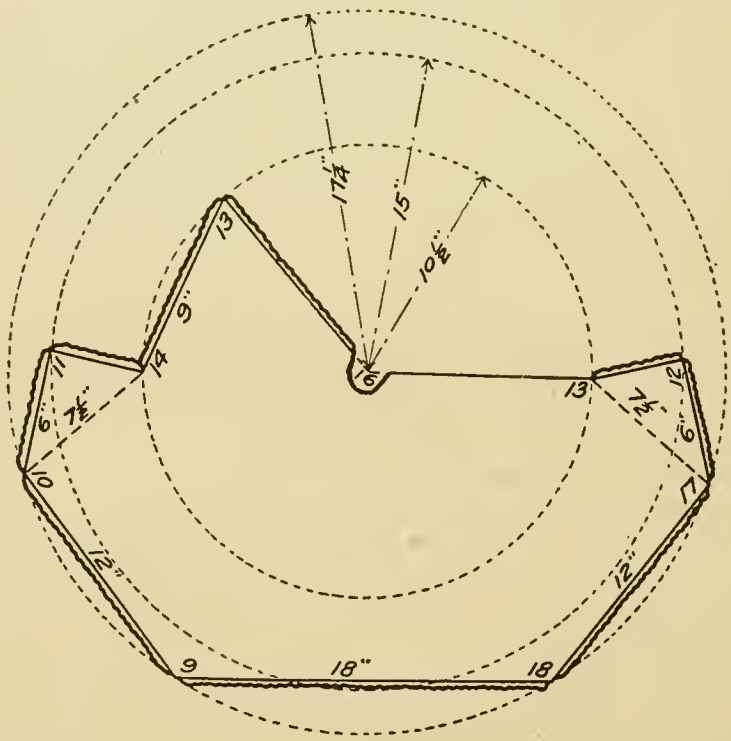


Fig. 6. — Pattern for second funnel of a trap to be 36 by 18 by 12 inches. (After Biological Survey.)

young sparrows are able to take care of themselves, which is usually by July 1. Each day's catch should be removed from the trap at nightfall, and if a decoy is used it should be comfortably housed and otherwise cared for when off duty.

In removing sparrows from either a funnel or a sieve trap the receiving box shown (Fig. 9) will be found useful. It should be about 6 inches square and 18 inches long, inside measurement. The door, hinged at the bottom and turning inward, is controlled by the part of its wire frame extending through the side of the box to form a handle. The box as it appears in the figure is ready to be placed before the open door of a trap from which birds are to be driven.[1]

[1] Dearborn, Ned, The English Sparrow as a Pest, U. S. Dept. of Agr., Farmers' Bulletin 493 1912, pp. 17-20.

Mr. Charles W. Miller, formerly director of the Worthington Society for the Study of Bird Life, has perfected an excellent trap for sparrows which has been very successful, but as its construction is more complicated and its manufacture more expensive than that of the funnel trap, those who desire to try it are referred to Farmers' Bulletin 493, in which it is illustrated and described.

A Warning. — All traps set for English sparrows are likely to catch native sparrows. Therefore baited traps should not

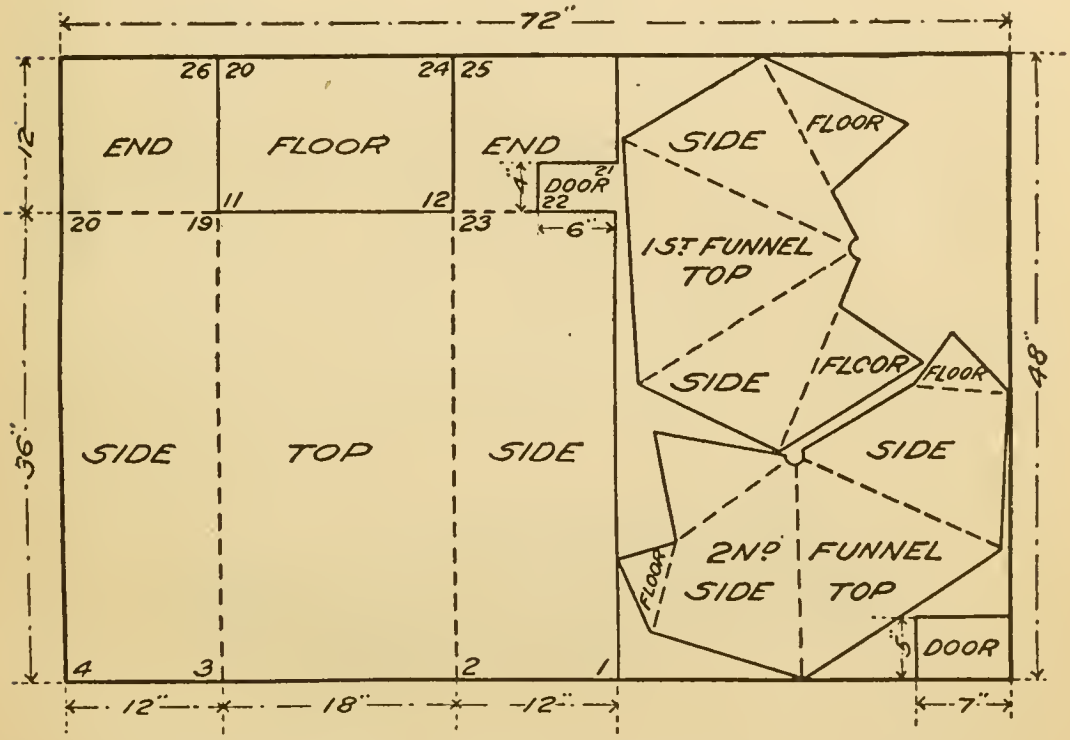


Fig. 7. — Diagram for cutting out the parts of a funnel trap 36 by 18 by 12 inches. (After Biological Survey.)

be used in the nesting season, and their use should not be delegated to servants or others who cannot distinguish native from introduced sparrows. All traps should be examined often, as native birds left long encaged will injure themselves in trying to escape.

English sparrows are so wary that it may be difficult to entrap them. Traps have given best results in Massachusetts in winter, after storms, when snow covers much of the natural food of the sparrow. It is not to be expected that trapping will succeed if the sparrows can get all the food they need in some near-by poultry house or stable yard. Some poultrymen who

keep grain constantly before the fowls probably feed nearly as much to rats and sparrows as to fowls. Poultry should be fed indoors; every poultry house should be rat proof, and all openings should be covered with cellar wire netting which will keep out rats, mice and sparrows and save the poultryman more than its cost in a single year. Where poultry foods are thus pro-

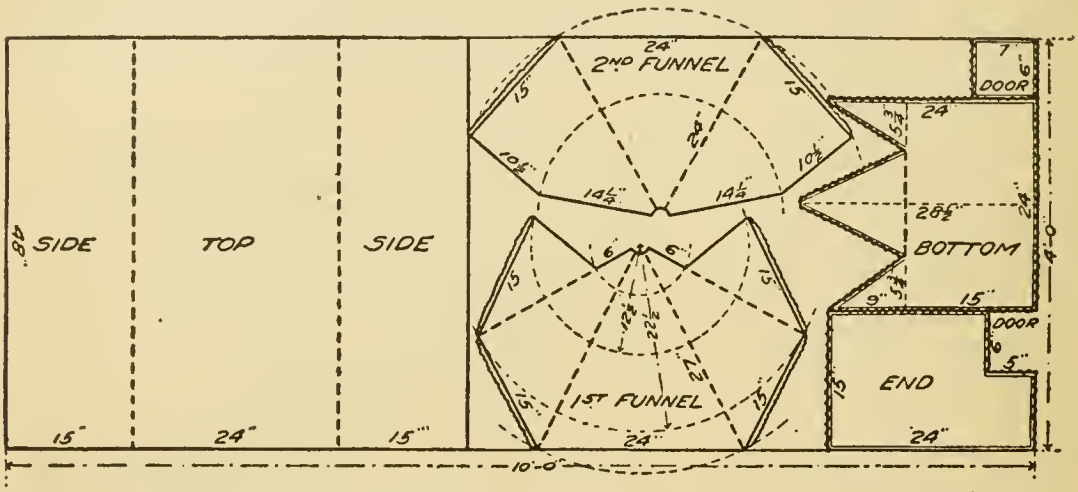


Fig. 8. — Diagram for cutting out the parts of a funnel trap 48 by 24 by 15 inches. (After Biological Survey.)

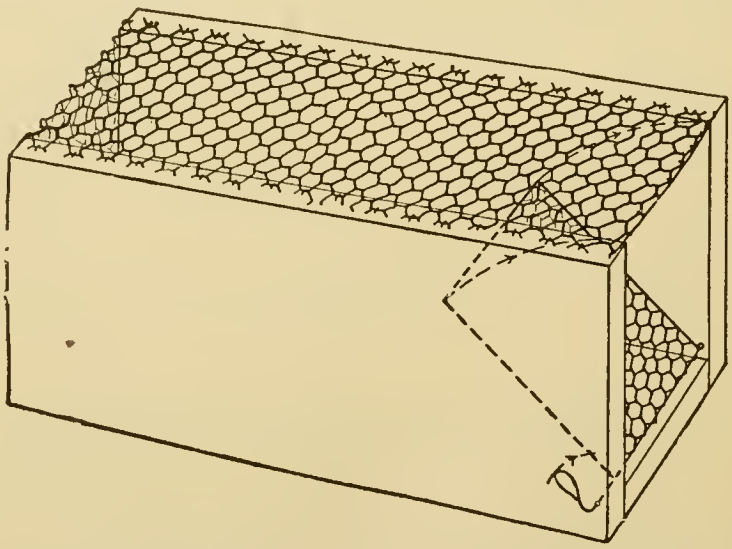


Fig. 9. — Receiving box for removing sparrows from trap. (After Biological Survey.)

tected sparrows may be caught with ease. Any poultryman may catch large numbers of sparrows in winter by closing all but one opening in a henhouse and enticing the birds in by means of grain. After they have been well fed in this building for a week or two, and have become accustomed to feed there

in numbers, the opening may be closed from a distance by means of a cord attached to a shutter or sash or to its support, and the sparrows may be imprisoned and killed. Another plan is to imprison them in the afternoon and let them out in the morning until they have become accustomed to roost in the building in large numbers, when they may be readily despatched at night. Mr. Wilfrid Wheeler, commissioner of the Massachusetts State Department of Agriculture, reports success with this plan.

Poisoning.

The use of poison generally cannot be recommended, but when used with great care it has given excellent results. Successful methods are given below.

The following formula and directions for poisoning English sparrows are given by Ned Dearborn of the Biological Survey, United States Department of Agriculture: —

Where the use of poison is not prohibited by law it may be employed effectively to reduce the number of sparrows. Of the different poisons tested the most satisfactory is strychnine, which is easy to prepare and acts quickly. Wheat has proved to be a good bait as well as an excellent vehicle for administering the drug. A convenient method of preparing poisoned bait is as follows: put one-eighth ounce of pulverized strychnine into three-fourths of a gill of hot water, add 1½ teaspoonfuls of starch or wheat flour moistened with a few drops of cold water, and heat, stirring constantly till the mixture thickens. Pour the hot poisoned starch over 1 quart of wheat and stir until every kernel is coated. Small-kerneled wheat sold as poultry food, if reasonably clean, is preferable to first-quality grain, being cheaper and more easily eaten by the sparrows. A 2-quart glass fruit jar is a good vessel to mix in, as it is easily shaken and allows the condition of the contents to be seen. If the coated wheat be spread thinly on a hard, flat surface it will be dry enough for use in a short time. It should be dried thoroughly if it is to be put into jars and kept for future use. Dishes employed in preparing poison may be safely cleansed by washing.

Other seeds, as oats, hemp or canary seed, may be used instead of wheat in the above formula, but they are less economical because much of the poison is lost when they are hulled, though enough of it usually sticks to the mouths of the sparrows to produce fatal effects. As wheat has no hull that a sparrow can remove, it is ordinarily preferable to other seeds. Bread, in thin slices, spread with the strychnine-starch mixture may be used to advantage alternately with seeds.

In case it is impracticable to poison sparrows at their regular feeding grounds they may be attracted to a suitable place by preliminary baiting.

In northern latitudes the best time to put out poison is just after a snowstorm, when other food is covered. The feeding place should be cleared of snow and the poison laid early in the morning. The poison should be well scattered, so that many birds may be able to partake at the same time, since after a few are affected their actions excite the suspicion of their comrades. Usually a few sparrows get only enough strychnine to paralyze them for a few hours, after which they recover. It is important, therefore, to visit the feeding places a short time after distributing poison to prevent such birds from escaping. It is well, also, to remove dead birds promptly to avoid exciting the suspicions of those that are unaffected. In deciding the amount of poisoned wheat to put out at one time, it is well to estimate the number of sparrows frequenting a feeding place, and to allow about 20 kernels for each sparrow. Although 2 kernels of wheat coated with the solution described below have been known to kill a sparrow, 6 or 7 kernels are required to insure fatal results, and much more than a fatal dose is frequently taken. The sparrows that recover after taking poison or that become frightened by the death of comrades, will forsake a feeding place if poison is kept there constantly. If, therefore, one wishes merely to keep them off his land he can do so by maintaining a supply of poisoned bait for them. On the other hand, if extermination is the object sought, unpoisoned bait should be put out after each killing until the birds have recovered confidence. There is an advantage in having several feeding grounds that may be used in rotation with different kinds of bait. Under these circumstances the sparrows forget their fear of each feeding ground while the others in turn are baited. Only as much poison should be put out as is likely to be eaten in one day, since exposure to moisture reduces its virulence. Any grain coated by the above process and left on the ground will become harmless after a few rains.[1]

During several years Dr. C. F. Hodge, formerly of Clark University, Worcester, organized a very effective campaign in Worcester for destroying English sparrows. His poison formula is as follows: Dissolve one-eighth of an ounce of powdered strychnine sulphate in one-half pint of boiling water. He gives the following directions for using his formula: —

Pour this, while hot, over two quarts of wheat (or cracked corn), stir well, and continue stirring from time to time, until all the liquid is absorbed. Dry thoroughly, without scorching, and put away in some safe receptacle, labeled "Poisoned Grain. Strychnine". . . . Expose the grain where poultry and tame pigeons cannot get it, and by operating only during the winter there will be no danger of poisoning seed-eating

[1] Dearborn, Ned, The English Sparrow as a Pest, U. S. Dept. of Agr., Farmers' Bulletin 493, 1912, pp. 20–23.

wild birds, at least for all northern towns and cities. By taking advantage of the sparrows' gregarious habits, and the fact that they drive off other birds from localities where they are numerous, much might be done even in the south.

Sparrows are such suspicious and cunning birds that, if the strychnized grain be exposed at first, they will probably roll each kernel in their bills, taste it, reject it, and possibly refuse to touch it again that winter. The best way is to select a safe place, where the wind is not likely to scatter it, — a walk, driveway or porch roof with a smooth surface, — so that the grain may be swept up after each trial. Accustom them to feeding there daily with grain exactly like that which is medicated (I often do this for a week or even a month, until all the sparrows in the neighborhood are wont to come regularly), study the times when they come for their meals, and then on a cold, dry morning after a heavy snowstorm, having swept up all the good grain the night before, wait until they have gathered, and then put down enough strychnized grain to feed the entire flock. You have about ten minutes before any begin to drop, and those that have not partaken of the grain by this time will probably be frightened off; but, by timing it properly, I have repeatedly caught every sparrow in the flock. I have found morning the best time, as they all come then; and it is essential to success to select a dry day, since in wet weather they taste the strychnine too quickly; I have seen them actually throw it out of the crop.[1]

Shooting.

For ten years my farm was kept clear of sparrows by the practice of shooting promptly the first one that appeared. They never got a foothold, never nested there, and did practically no harm, although they were domiciled on the premises of my neighbors where they drove out a large colony of cliff swallows and all the bluebirds, tree swallows and martins. Shooting is very effective if the sparrows are greeted with a charge of shot or a bullet every time they appear, and they soon learn to fly high where they get such a greeting. A skillful rifleman may pick off individual sparrows with a good air gun or a Flobert or other small 22 caliber rifle as they come to feed or to the nesting box, but most people have better success with a small shotgun and number 12 shot. If smokeless powder and small-bore weapons are used the noise of an occasional shot will not disturb native birds, and in some cases they seem to be gratified by the destruction of their garrulous,

[1] Hodge, Clifton F., Nature Study and Life, 1902, pp. 315, 316.

pugnacious enemy. Where sparrows are numerous a good plan is to scatter grain in a long line at a certain hour each day, and when the sparrows of the neighborhood have learned to gather promptly at the appointed hour the shooter who has concealed himself for the purpose shoots down the line. Thus nearly every bird may be killed at one discharge of the gun. If the sparrows frequent poultry houses where there is danger of shooting fowls the bait may be placed on a long narrow board above the fowls' heads. Persistence in the use of such methods as those detailed above will tend to make any premises so unsafe for sparrows that they will prefer to reside elsewhere.

Co-operation in Sparrow Killing.

In many parts of Europe, where a constant warfare is waged against this bird, clubs are formed for the purpose of killing sparrows. In some cases each member of such a club is bound to present to the secretary the heads of a certain number of sparrows each year or to pay a fine. The fines thus collected are used as prizes for the members killing the most sparrows. The honorary secretary of the Stratford-upon-Avon Sparrow Club reported that during the year 1887 over 19,000 birds had been killed. About 20,000 a year is the average number destroyed in the neighborhood of Stratford-upon-Avon.

Similar clubs have been formed in some parts of the United States. In one sparrow hunt in Woodworth, Ohio, 26 men killed 980 sparrows.[1]

Bounties.

The theory that a bounty should be offered to encourage the extermination of the English sparrow has had many friends, but where this plan has been tried it has not given satisfactory results.

Dr. Barrows, in his report on the English sparrow, makes an estimate of the cost of exterminating sparrows by bounty in the State of Ohio. The sum required exceeds $11,000,000. Michigan and some other States have tried the plan of exterminating sparrows by bounty, with very unsatisfactory results. Not-

[1] Barrows, Walter B., Bull. 1, U. S. Dept. of Agr., Division of Economic Ornithology and Mammalogy, The English Sparrow in North America, p. 166.

withstanding the payment of considerable sums of money, the number of sparrows did not seem to decrease; also, it was found that birds of many species, most of them useful native birds, were killed as sparrows by hunters for the bounty, and in very many cases bounties were paid on their heads. A reward offered for the destruction of English sparrows would be certain to bring about the death of numberless native birds.

Protecting Grain, Fruit and Vegetables.

Where sparrows are numerous and become destructive to growing grain, shooting in spring, summer and autumn, and poisoning in winter are the only remedies known. When the grain is ripening the crop may be protected by boys armed with guns and kept constantly in the field from dawn to dark. Powder may be used mainly to frighten the birds, and a charge of shot may be sent after them occasionally when they cease to fear blank cartridges. Large clappers made of boards to imitate the sound of a gun are used in England and might be utilized here a part of the time to drive away the birds and save powder. Similar means may be used to save fruit, but English sparrows are not now generally destructive to fruit in Massachusetts, as their numbers have been much decreased by a severe winter. If the fruit plot is small it may be covered during the ripening season with a fine-meshed fish net. A few cherry trees are sometimes protected in this manner. Young plants, such as peas, cabbages, etc., have been saved from the sparrow by covering the rows with small branches.

To prevent Sparrows taking Food designed for Native Birds.

Many people have complained that where seed, suet and other food have been put out for winter birds on feeding tables or shelves sparrows have taken all or nearly all the food. Sparrows do not like swinging shelves which may be hung by wire, or better yet by spiral springs, which make them still more unstable. Native birds use such shelves. Where sparrows eat suet it may be crowded into auger holes bored in sticks, and the sticks may be fastened to the under side of a

limb where woodpeckers, nuthatches and chickadees will easily get at the suet. Sparrows seldom will take the trouble to cling to the underside of a limb. This subject is treated more fully in Circular No. 2 of the Massachusetts State Department of Agriculture, entitled "Food, Feeding and Drinking Appliances, and Nesting Material to attract Birds."

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 5

March, 1919

TURKEY RAISING

Miss MARGARET MAHANEY

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

3-19-1,000

TURKEY RAISING.

MISS MARGARET MAHANEY, CONCORD, MASS.

To those who are thinking of undertaking to raise turkeys, the proper time to begin is in the fall. For stock, select heavy-bodied hens with good round breast, broad back, round eye, feet far apart and head well set up. You want an intelligent looking bird. For show, the wings must be well barred and the feathers all over the breast must be white tipped. She must be a good bronze.

It should be fully understood that size and constitutional vigor come largely from the female, and to have this developed to the fullest extent, well proportioned, vigorous females must be selected as breeders. A strong, healthy tom weighing from 25 to 40 pounds is generally what I have in my flock; a good bronze, well barred wings, broad neck and deep chest, and when he stands straight up his tail must touch the ground. This is the most profitable stock to breed from.

I have warm, sanitary houses with board floors which are cleaned off every day in cold weather and furnished with dry straw. The dropping boards are watched very carefully for yellow droppings, as they are the first sign of "blackhead." It is a very easy matter to single out the affected bird, as the whettle under the neck will be drawn up and the head will be a grayish color. That bird should be taken away, and an examination made to see if she has any undigested food in her crop. It is almost impossible to do anything with a bird which has undigested food in her crop. To overcome this, take 1 tablespoonful of ginger, one-half teaspoonful of common baking soda, 1 teaspoonful of charcoal and moisten with castor oil; make into pills the size of a small bean, and give one pill to the turkey three times a day, with 1 tablespoonful of warm milk and a little stimulant; massage the crop gently. In a few hours the gas will begin to come into the crop, the food

will digest, and you will find that your bird is on the road to recovery. A great many birds have been saved this way.

To prepare my birds for the breeding season I keep before them charcoal, grit and oyster shells; and in the drinking water once a week, in the morning, I put one-half teaspoonful of common baking soda to a gallon of water for eight turkeys. This will sweeten the crop and help to tone up the bowels. If you feed corn to your grown turkeys in the winter, feed it at night, and on cold nights it is well to warm it, as it is not so apt to cause diarrhœa. If impossible to get turkey feed, try to keep before them ground wheat, oats and barley, 5 pounds of beef scraps to 100 pounds of mixed feed, with 1 pint of air-slacked lime mixed well into the feed. In the laying season, if you have any sour milk to spare you will find it a great benefit.

To one pen of eight hens I keep one tom. To persons going into the turkey-raising business on a large scale I should advise the keeping of three or four extra toms so that if anything happened to one tom, they would have good, clean breeding stock to fall back on. Try to win the confidence of your stock, and have them trust you. Speak low and gently, and you will find your success with them will be much better.

I would suggest having four good nests to each pen, these to be deep, containing a plentiful amount of straw. The nest may be built in a small packing case, the only opening being towards the wall, and a china egg placed in the nest about the 1st of March. The turkey hen likes a dark, secluded nest, and will set for a short time daily, even before she is ready to lay.

A strong turkey hen should lay about 30 eggs in her first litter. These may be hatched out under common hens. I use a bushel box, filled with good coarse hay, and make a round nest, stuffing the four corners well so that the eggs will not roll, and filling the box so the nest will not be too deep. The hen should be able to get on to the nest without jumping.

When the hen shows signs of setting I take her away to another pen, and in a very short time she will be ready for the second litter of eggs, at which time I generally set her.

When a turkey hen is setting she has to have very good care.

She is a very close setter, and will set for days without getting off her nest, which is the reason so many hens die on the nest, as they weaken from want of food, water and exercise. On going out in the morning to feed my stock, the first thing I do is to gently lift the setting hens from their nests and shut them out of the hatching house until I am through feeding all the other stock. This sometimes takes three-quarters of an hour, gives the eggs a chance to cool, and allows the bird to have fresh water, green grass and exercise. A turkey hen treated in this way generally improves by the rest obtained in the hatching season, and, when she leaves the nest with her brood, her head is red and she is in good condition. I have a nice clean coop all ready for her.

The first feed given the little poults is hard-boiled eggs chopped up fine, and sting nettle, with a shake of red pepper or ginger. If you cannot get the sting nettle cut up dandelions. I plant a good field of lettuce during the summer, and give them all they can eat three times a day during the hot weather, as there is a considerable quantity of iron in the lettuce, and the little poults thrive on it.

When they are about two days old I soak bread in milk, squeezing it dry, and add it to the chopped dandelions. As stated previously, if you cannot get turkey feed you will have to grind up wheat, oats and barley, with a shake of lime. Charcoal and baby grit should be kept before the poults all the time, and all the sour milk they can drink should be given them. When they are about three weeks old give them a mash made as follows: for 12 poults take 1 pint of cornmeal and 1 quart of mixed feed, and if you have plenty of milk make it with that, but it must be as well cooked as cereal for the table. It is also well to give the little poults broth made from bones. This will help them "shoot the red." They should be yarded up in runs 5 feet each way, and 23 inches high, until they are good and strong. After they are a week or ten days old they may be let run about half a day while the dew is off the grass. When poults "shoot the red" they may be allowed to run all day in good dry weather. As cold and wet weather are considered the chief causes of "blackhead," young turkeys should not be allowed to get wet the first year.

The little turkeys are housed in common portable houses which are found very good, having open fronts with wire nettings. The tops are raised on hot nights, admitting plenty of pure air. My improved turkey houses are 6 feet long, 7 feet deep and 5 feet wide, and will each hold 8 full-grown turkeys.

After turkeys are four months old they may be turned into larger sheds, thus necessitating less work. About twice a week on hot days the little poults should be given a teaspoonful of epsom salts to a gallon of milk or water, to cool the blood and clean the bowels. A few drops of tincture of iron once or twice a week in the drinking water is a great benefit.

When the cold rains come on during the fall, if people would only keep their stock dry and warm and well housed their losses would be a great deal less.

If, on cleaning out the young poults' coops in the morning, any yellow or white droppings are discovered the affected bird should be found and removed from the house, which must afterwards be disinfected. If there is any undigested food in the bird's crop she should be given the same pill recommended for similarly affected grown turkeys. After the food has been digested the treatment for "blackhead" should be administered.

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 6

March, 1919

FACTORS AFFECTING HARDINESS IN FRUITS

U. P. HEDRICK

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

3-19-2,000

FACTORS AFFECTING HARDINESS IN FRUITS.

PROFESSOR U. P. HEDRICK, HORTICULTURIST, NEW YORK STATE EXPERIMENT STATION, GENEVA, NEW YORK.

The chief hindrances to fruit growing in North America are winter freezes and spring frosts. No part of the Continent where fruits are grown, excepting favored portions of California, is free from the danger of a freeze that will kill the trees, or a spring frost that will destroy the blossoms. The losses suffered during the winter and spring of 1917 and 1918 threaten the existence of some fruits in many parts of the United States and Canada. One of the problems which growers of fruit now face is how best to avoid or check injury from freezes and frosts.

The problem is not an insurmountable one, for one finds here and there varieties of orchards almost or wholly uninjured, and possibly adjoining others with trees or buds partly or wholly killed. What conditions of the trees, of the soil, or of the care make the difference? There must be reasons for the injury of the one and not of the other. If we could intelligently explain the eccentricities and anomalies of winter-killing and spring frosts we might do something to avoid injuries from unseasonable weather.

The writer has made two efforts to find some explanation of the varying behavior of peach trees during freezes and frosts. In the spring of 1905 he addressed letters to about 100 of the best peach growers in Michigan, asking for their experience as to the hardiness of the peach in tree and bud. In the spring of 1907 about the same number of letters were addressed to peach growers in New York.

This paper is a brief review of the answers obtained. The great importance of the subject seems to have been obvious to the peach growers, for almost without exception answers were given by those addressed, and in such manner as to show

their interest. The experiences given and the theories advanced are many and conflicting, but out of the great mass of material obtained there is much that is suggestive.

1. Influence of Soil on Hardiness.

It is usually held that trees are hardiest on sandy, gravelly or stony soils. In the orchards of Michigan the growers consulted held this to be the case almost without exception. But in New York the kind of soil seems to make but little difference, providing it is warm and dry. If these two factors be favorable, even the tender peach seems to thrive in any of the soils of New York.

In the investigations made, then, this point is clear; the peach must have a warm, dry soil to secure the greatest possible hardiness inherent in the species. This holds with all fruits. Only in such a soil can trees make a strong, firm, well-matured growth that seems to be conducive to hardiness. A warm soil is especially necessary to secure a growth that will withstand cold. Plants in a warm soil, so physiological botanists tell us, have more and smaller cells in their tissues, and therefore a more condensed sap, both of which conditions seem most favorable to hardiness.

Many growers in both States speak of the desirability of a gravelly subsoil to secure a hardy tree. Such a subsoil seems to be conducive to the warmth and dryness of roots, and it is probable that, so far as hardiness is concerned, it matters little whether this subsoil be overlaid with sand, gravel, loam, clay or combinations of these.

2. Does the Amount of Moisture in the Soil in Winter affect Hardiness of Trees?

The evidence as regards this point is clear. Either extreme of moisture — excessive wetness or excessive dryness — gives favorable conditions for winterkilling. A wet soil is conducive to sappiness in the tree and also freezes deeply.

On the other hand, severe cold, especially cold alternating with warm weather or accompanied with dry winds, causes evaporation of water from trees, and if the soil be so dry as not to furnish moisture to replace the evaporated water,

harmful results ensue. Several experiences were given in Michigan in which trees were injured far more from the winter freeze in a dry than in a wet soil in the same orchard. It is a matter of common observation among fruit growers that twigs and buds which are more or less shriveled in winter from lack of water or lack of maturity are almost invariably winterkilled in cold winters.

3. What Effects do Fertilizers have on Tree Growth, and hence on Susceptibility to Cold?

It has long been thought that fertilizers with any considerable amount of nitrogen, as barnyard manure, cause trees to make a heavy, rank, soft growth susceptible to freezing. This theory finds expression in such statements as: "Hardy under neglect;" "Tender under high culture." The majority of the growers consulted in this investigation still hold that such is the case, but a very considerable number of them, and among them some of the best fruit growers in the two States, say that trees are more likelv to suffer from cold if underfed than if overfed.

Their experiences indicate that vigorous vegetable growth in early summer can be made of great service in counteracting cold, and that half-starved trees, or those which have been allowed to bear too heavily, are apt to suffer most from freezing. The influence of the preceding crop was strongly shown in orchards of all fruits last winter, 1917–18. In all orchards where the trees bore a light crop the preceding summer there was less injury than with trees that bore a full crop. By using properly balanced fertilizers, by stopping cultivation at the right time, and by judicious pruning, so that the growth can be kept firm, the top of the tree compact and the branches well set with buds, conditions favorable to hardiness can be obtained. It is common knowledge that late fall growths are susceptible to winter injury of both wood and bud.

4. Do Cover Crops protect Trees from Cold?

There were no conflicting opinions on this point. Growers who had planted cover crops were agreed as to the value of this method of protecting trees from winter freezing. Many

individual cases were cited of orchards having cover crops surviving the cold winter when near-by orchards without the covering crop, holding a muffler of leaves and snow, were killed. Fruit growers in the two regions consider the cover crop the most effective treatment of their orchards to avoid winterkilling, holding that they protect the roots from cold, cause the trees to ripen their wood quickly and thoroughly, and that they assist in regulating the supply of moisture.

5. Is there Any Difference in Hardiness between Low-headed and High-headed Trees?

All growers in both States prefer low-headed trees, claiming that both trunks and branches are more often injured in high-headed trees. If this be true the reasons probably are: winds dry out the wood of high-headed trees, making them more susceptible to cold; low-headed trees are usually more vigorous and therefore less susceptible to cold; and lastly, low-headed trees have better protection to the trunk from the sun and hence from sunscald, one of the effects of freezing and thawing. Attention is called by several growers to the fact that buds on high-headed trees usually suffer less from spring frosts.

6. Are Windbreaks a Protection to Trees or to Buds?

There was much difference of opinion. From the experiences given it seems that the value of a windbreak depends largely upon the topography of the land. A windbreak so situated as to form still air can only be detrimental so far as cold is concerned. So planted as to deflect or to cause air currents they become of value in keeping off frosts. More often than not, however, windbreaks seriously check atmospheric drainage, and the damage by frost is increased. Another disadvantage is, should the windbreak be to the north, the buds on the trees thus sheltered are forced and are therefore more liable to injury by late frosts. The testimony was, for the most part, unfavorable to windbreaks.

7. What Degree of Cold will kill Trees?

There was a most surprising uniformity in the answers to this question. Nearly all of the correspondents set 20° below zero as the temperature that will kill the peach tree under normal conditions, though some had known them to withstand temperatures of from 20° to 30°, depending upon the condition in which the trees went into winter.

During the almost unprecedented cold of last winter in New York sweet cherries were quite as tender as peaches; pears were a little but not much hardier than peaches; apples were, of course, hardier than pears, but some leading varieties of apples and pears, as Baldwin and Bartlett, are not much hardier than the hardiest peaches. Sour cherries were the hardiest of the tree fruits.

8. What Degree of Cold will kill Peach Buds?

From the answers to this question we are forced to conclude that much more depends upon the condition of the buds than on the temperature, assuming, of course, a temperature below zero and not greater than 25°, which seems to be the limit that peach buds can stand, even under most favorable conditions. The chief factors influencing tenderness of buds are maturity of buds; variety, and the time at which the buds of a variety finish their resting period and become ready to grow. Some of the factors influencing temperature are lay of the land, proximity to water, stresses of changeable weather, altitude, latitude and currents of air. Fruit buds of other fruits, sweet cherry excepted, are seldom injured.

9. Are Trees from Northern Nurseries Hardier than those from the South?

Many opinions were expressed, but few men had grown trees from different latitudes under such conditions as to answer the question fairly. The answers were in no way decisive, and the question is still an open one to be settled only by direct experimentation with trees of the same varieties from North and South, grown under identical conditions.

10. Does the Character of Individual Trees have Anything to do with Hardiness?

Answers to this question were very indefinite and often conflicting. It was held by some, and with a fair show of experience to confirm the contention, that trees naturally high-headed, with few branches, long, spindling trunks, branches and twigs, have soft wood and are therefore more susceptible to freezing; on the other hand, that individuals having naturally short bodies, a goodly number of branches starting low, with short-jointed wood bright and clear when cut, and thickly set with buds, were the least easily injured by cold.

The individuality in these two classes of trees is given them by treatment and environment, as pruning, cultivation, soil and distance apart. One tree of a variety can hardly be supposed to be more hardy to cold than another through inherent variation. Whether greater inherent hardiness exists in some trees in a variety can be determined only by carefully conducted experiments.

11. Are Small-growing Varieties of Peaches with Compact Heads Hardier than the Free-growing Sorts with Large Heads?

Practically all growers say that the compact growing sorts are the hardiest. As would be expected, the small-headed varieties are those with the least succulent wood. The following varieties are named as being the most compact growers, and hence hardier than the average: Hill's Chili, Crosby, Gold Drop, Barnard, Kalamazoo, Triumph, Wager and Fitzgerald.

12. Is the Wood of Some Varieties More Succulent than that of Others making Such Sorts susceptible to Cold?

Every experienced orchardist or nurseryman knows that there is a great variation in the texture of wood. Some varieties have a much more succulent growth than others grown under the same conditions. Succulency of growth is in some cases a well-marked varietal character, and one that can be avoided in selecting sorts to plant where hardiness is a requisite. Summarizing the answers from New York

and Michigan the following are the peaches most often named as having the softest and sappiest wood: Early Crawford and Late Crawford are named by practically all correspondents as being most succulent in growth, following which, named in order of degree of succulency, come Chair's Choice, St. John, Niagara and Surprise.

13. Are Young or Old Trees Hardiest?

Beyond all question young trees suffer most in severe winter freezes. Practically all fruit growers agree to this, and as proof, growers give their experience in the several severe freezes that have occurred during the past few years in which young trees universally suffered most. It is probable that young trees are injured most because they make a much greater and much ranker growth than the older ones, and hence more sap remains in them during the winter. The formation of buds in the older trees is helpful, too, in maturing the wood. There are, however, many exceptions to the statement that young trees are less hardy to cold than old ones.

Old trees can be forced to produce large quantities of new wood susceptible to winterkilling, while, on the other hand, the superabundant growth of young trees can be kept down by orchard treatment. It is fair to assume, too, that old trees possessing very low vitality are less hardy than vigorous young trees. Thus it is often to be noted that old trees which have suffered from the ravages of insects and fungi are easily killed by cold.

While young trees are more susceptible to freezing than old ones, yet they are much more likely to recover, if recovery is possible, and their return to a normal condition is more rapid. This is probably true because of the greater vigor of the younger plants, and because of the possibility of an entirely new covering of bark for small trees often impossible with larger ones.

14. Name the Varieties Most Hardy in Wood.

There was, as would be expected, great difference of opinion as to the sorts most hardy. The following peaches, in order named, are possibly most hardy: Crosby, Hill's Chili, Gold Drop and Wager. Carman, Belle of Georgia, Elberta, Cham-

pion and Greensboro, none of them in the lists of hardiest, are hardier than the average.

The Russian apples seem to be perfectly hardy in the apple regions of the United States, the most prominent of these being Yellow Transparent, Red Astrachan, Oldenburg and Wealthy. McIntosh and Fameuse follow the Russians in hardiness. Seckel and Kieffer stand out as the hardiest pears, while Windsor is probably the hardiest sweet cherry.

15. Name the Varieties Most Tender in Wood.

Here, too, opinion differs, but not so much as in naming the lists of hardy sorts. The list of peaches runs: Early Crawford, Late Crawford, Chair's Choice, St. John, Niagara.

In the last terribly cold winter in New York Baldwins proved most tender to cold, followed, among standard sorts, by Rhode Island Greening, Northern Spy and Ben Davis.

Recommendations.

What lessons are to be learned from the data set forth? It is plain enough that some varieties of every fruit are inherently hardier than other varieties, and that selections of hardy sorts can be made for doubtful situations. Again, all can agree that hardiness is in great measure dependent on maturity of the plant, not only of the whole tree, but of parts of the tree, those parts with the poorest sap flow being least hardy. It is well established, also, that soils may be either too wet or too dry for the hardiest condition possible. It is probable that cover crops and snow offer the best protection against winterkilling of the roots. It seems certain, from the data in hand, that overbearing in the season preceding a cold winter weakens trees so that they are susceptible to cold, as also do the attacks of insects and fungi. Lastly, and possibly most important, the notion that trees are hardier under neglect than under high culture seems false; the more vigorous the tree, provided it matures its wood, the hardier.

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 7

March, 1919

FRUIT MARKET POSSIBILITIES IN THE EXPORT TRADE

A. W. OTIS

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

3-'19-1,500

Fruit Market Possibilities in the Export Trade.

A. W. OTIS.

The subject assigned to me — "Fruit Market Possibilities in the Export Trade" — is a very broad one, and is open to consideration in many different ways.

The first word, "Fruit," is a general term, and the word, "Export," has to do with the marketing field anywhere outside the United States. We know the United States is a very large and important part of the world at the present time, at least, but when it comes to consideration of fruit market possibilities there are some very important markets outside our own country.

Apple Exports.

Apples have been shipped from the United States to Europe for approximately sixty years. My own experience dates back to 1880, and while considerable quantities had been shipped prior to that time, the season of 1880–81 was the beginning of a very important branch of the apple business. The exports that season were, in round numbers, 1,300,000 barrels. The quantities have varied from season to season according to conditions, — some seasons being about the same as 1880, and others much lighter, — but the next really important season was that of 1896–97, when nearly 3,000,000 barrels were shipped. I say "important," not because of the really satisfactory financial results for those in the business, — as for many it was disastrous, — but for what it did for the apple growers in opening up new markets.

The crop was enormous in growing districts. Growers hardly knew what to do with their fruit, and some wished they had let it rot on the ground.

Thousands and thousands of barrels were sold for 75 cents per barrel, packed and delivered on board cars, or less than barrels cost now. Even at this, buyers lost 75 cents, and more if they had money to make good the deficits on their sales.

The season had its bright side, for by January the bad returns had caused very many shippers to stop entirely, and the low prices in England had been the cause of opening up new markets, and after January 1 there was a general improvement and a very good business. The benefit, however, came in later years, as the low prices had created an increased demand for American apples which has continued up to the present time.

In the summer of 1897 we had many new concerns from the other side represented here, looking for business, and they have been looking for American apples ever since.

In early years shipments were almost entirely sent to Great Britain, a very large percentage going to Liverpool, the balance being divided between London, Glasgow, Hull, Bristol and occasionally a few to other places.

Liverpool was the principal distributing market, — the others being more distinctly consuming markets, — depending on their own and near-by populations. Liverpool, being a great shipping port, handled immense quantities weekly, finding an outlet, not only in other places in Great Britain, but also on the Continent.

After a few years Germany became quite an important factor in the business, and was distinctly so just before the war. Hamburg had its free port established by the German government, which enabled it to build up a large business with Russia, Norway, Sweden and other places. Some of us, at least, hope this business will continue, but that it will be supplied either directly or through more friendly channels.

Other markets have developed in South America, Africa, Australia and other trans-Pacific ports.

The demand has grown steadily, and it is no exaggeration to say we have the world for a market. At the present time I have inquiries from Holland, France and the Scandinavian countries. Some of these places are not likely to be large

customers, but will doubtless want some of our apples every year.

In this connection I will refer to a personal trip taken in 1913 for the purpose of looking up new outlets, calling upon dealers in many places, from Naples in the South to Stockholm in the North. I found them interested in and ready to handle the American apple, but generally in a limited way, particularly in the South. I do not believe it advisable to ship to too many small places, but think it better to let them get their supplies from the distributing centres with which we have better steamer connections.

It is for the fruit growers to consider this export outlet, not as a sure thing, that will take whatever is sent and want more, but from a safe and sane standpoint, and do everything possible to increase the demand. A long step in this direction has been the standardization of packages and grades.

I believe the western grower did much to establish a good demand for his fruit by his methods of grading and packing. Within the past seven or eight years grading laws have been enacted in most, if not all, of the important apple-growing States in the East. It is gratifying to a fruit dealer, and certainly to an exporter, handling apples from all States to note the tendency to uniformity in these laws, so far as may be possible, considering the difference in fruit grown in the different States. A uniform grading law is, I believe, ready to be submitted, if not already acted upon, in the six New England States. I would urge you all to do what you can to have the law established. It probably is not perfect as drafted, but it will do much to establish the apple business on a more solid foundation.

Varieties handled in the export trade are worth considering. For years the Baldwin was very largely the apple of commerce. The Ben Davis, a variety not very popular in our markets, follows the Baldwin in the export trade late in the season, giving very good results frequently to shippers. A recent letter even mentioned the Ben Davis as being more desirable under the present abnormal market conditions, than some larger and very handsome apples. The Baldwin to-day is a standard variety, but other apples from other parts of the

country than New England are sought for by many foreign dealers. The Newtown Pippin, from the Hudson River district, was considered for years as the highest-priced apple in the English markets. It was available in very limited supplies, and I recall some years ago that sales were made at 70 shillings, or, in our money, about $16.70, and it seemed an extravagant price. At the present time the English government has established a maximum price for the receiver to sell barrel apples at 67 shillings and 8 pence, — equal to $16.06. All varieties and grades have sold at this price, except some apples arriving in very poor condition. We should, however, remember that the present conditions are very unusual; the country is bare of fruit and the people almost famished for apples. In the same family with the Hudson River Newtown, but quite a different apple, is the California Newtown and the Hood River Newtown. Both are very popular, especially in London. What surprises a New England fruit man is why a California Newtown sells in such quantities, as from our viewpoint it is not attractive, and still London buys them by hundreds of thousands of boxes every year.

In 1880 the exports from Boston were almost entirely from the dealers in and around Quincy Market, and, at the most, there were not over fifty different shippers from Boston. From that time the business has grown by leaps and bounds, and it is safe to say there is not a grower or apple dealer of any importance in this country who has not some knowledge of the foreign markets and their bearing upon market conditions here.

Districts which may be named as very much interested in the export business are the following: Maine, New Hampshire, Massachusetts, New York, Virginia, West Virginia, California, Oregon and Washington.

Transportation is a very important point to consider. From the beginning the steamship companies have been interested in apple shipments, and looked upon the business with favor. When building new steamers the requirements of the apple shippers were considered with regard to proper ventilation. At the time the war broke out we had many popular steamers

in our Boston trade, some of them capable of carrying 20,000 to 30,000 barrels in good condition. I regret to say most of the favorite steamers have been lost, and we are now glad to take what the steamship companies offer, and I doubt if an exporter would seriously object to anything that would float.

The methods of handling apples in the different foreign markets vary, though the auction is a more general and usually satisfactory way for distribution. It means a quick sale and prompt returns, as well as fair dealing for seller as well as buyer.

Packages for export business should have consideration. The standard barrel has always been recognized as a proper package, but should be well made, and properly coopered. Boxes, such as are used in the West, are not, in my opinion, to be recommended for New England export business, at least.

The Boston bushel box has been growing in favor for several years, and it probably has come to stay in the export business. It should, however, have special attention when being made to have it strong, or otherwise losses will be heavy.

To sum up the question as to the export marketing possibilities for American apples, I would say the business has grown from a very small beginning; the apples are now known in nearly every country in the world, and, with normal times in the shipping business, we shall have a demand for our fruit every year in such quantities and on such terms as to have a very important bearing on the apple-growing business of the United States.

Besides apples, pears have been shipped in increasing quantities for many years prior to the war. The pear is so tender it has been considered necessary to have refrigeration on the steamers. We have no records as to the quantities shipped, but do not think any considerable shipments from New England have been sent. Our pears are almost too tender and will not keep, and Pacific Coast pears, New York State Bartletts and Kieffers have been exported in considerable amounts; also some plums, prunes and other summer fruits. Cranberries from New England and oranges and grapefruit from Florida and California have been exported in limited quantities.

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 8

April, 1919

The Efficient Management of Labor on the Farm

F. C. SEARS

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

4-19-1500

THE EFFICIENT MANAGEMENT OF LABOR ON THE FARM.

FRED C. SEARS, BAY ROAD FRUIT FARM, AMHERST, MASS.

I suppose I should apologize to the farm management experts for presuming to talk on the subject assigned to me, and I do so apologize at once. But as a matter of fact, I shall not attempt to give a scientific discussion of the subject as they would do. I shall merely offer a few practical and more or less detached suggestions that have grown out of my experience in helping to manage the Bay Road Fruit Farm at Amherst, and out of my earlier experiences on my father's farm in Kansas.

Very few classes of people have had as many jokes perpetrated at their expense as the hired man. He is usually represented as inefficient, frequently as lazy, sometimes as dishonest, and occasionally as all three. And he is blamed for a large part of the failures in operating farms. "The thing would have gone all right if we could only have had efficient help."

Does he deserve this characterization? In nine cases out of ten he does *not,* if we consider the real, typical, rural hired man, and not the I. W. W. hobo who sometimes drifts out on to the farm merely with the expectation of passing some of his time there, and *not* with an honest intention of doing any work.

The hired man is pretty largely what his employer makes him. If he is well and efficiently managed he accomplishes a deal of work in the course of the year; if his employer has not any executive ability, does not know how to manage himself efficiently, let alone his hired man, then not much of anything is accomplished by the two combined. No one can study, even

casually, the work accomplished under two different foremen or owners without being impressed at once with the difference.

One man keeps all the loose ends gathered up, has something timely for his men to do every moment in the day, keeps his men happy and yet going at a high rate of speed, — in fact, drives his work instead of letting the work drive him. The other man plants his corn three weeks late so that it does not mature in the autumn; does not dig his potatoes in the fall till the ground has frozen enough to spoil a lot of them; puts up his ice in March, and says that farming does not pay. And he can prove it, too!

The writer holds no brief to defend the hired man. Doubtless there are many inefficient men among the class. But so there are among preachers and doctors. Probably as a class hired men are *not* as progressive as employers, else they would be employers themselves. But doubtless, also, if the tables were turned, and the employers were working for some one else, many of them would loose a trifle of their enthusiasm. Self-interest is a big help in keeping up one's interest in the task in hand. In any case, efficient, modern business management would accomplish wonders if it could be tried out on the average farm. So let us employers shoulder our share of the responsibility and try to improve our methods. If this is sound doctrine, if management can "cut the cost in two," it is certainly worth studying, and the following are some principles which have appealed to the writer in his experience in helping to manage a 400-acre farm during the past ten years.

1. Know exactly how much work is done each day by each man, and if it is not enough, find out why he did not do more. This is, of course, especially important with new men, because in this way one soon locates the man who, for one reason or another, is not accomplishing as much as he should. But it is a mighty useful practice, even with men who have been on the job for years. There are very few of us who are not helped in our work by knowing that somebody else is keeping an interested eye on what we are doing. This is not saying that we are loafers, — most of us are not, — but we take a pride in doing well, and that pride is increased and our effort stimulated if we know that what we accomplish is known by the boss.

2. Get the men interested in their rate of accomplishment,—so many acres plowed in a day; so many trees pruned in a day. This grows naturally out of the first suggestion, and is even more important than the first. If Mike is pruning apple trees ask him, when he comes in at noon, how many trees he finished that forenoon; do the same thing at night; and then, in the evening or Saturday afternoon, sit down with him and figure out how much it is costing the farm per tree to get the pruning done. Do the same thing with the boys who are thinning apples, and go around occasionally to talk the job over with them. Keep them posted as to how the cost of this week compares with that of last week or last year. It is much better to let the men keep their own records, even if the boss keeps them also as a check, because this very thing stimulates their interest in the matter. Another great advantage in interesting the men and boys in what they are doing, and in the rate at which they are doing it, is that it gives them something to think about. Some operations are more monotonous than others, and the more monotonous the operation the more important it is that the operator's interest should be stimulated. Take the job just mentioned, — thinning fruit. Few operations of the orchard are more important, and yet few, indeed, are more deadly monotonous. There is no change, no let-up. Hour after hour, day after day, week after week, just pulling off those tiresome little apples and letting them fall to the ground. One does not even have the satisfaction of filling up baskets with them, and thus feeling that he is accomplishing something.

Moreover, we must remember that the hired man or boy does not derive the same satisfaction that the owner does from the thought of how much good he is doing to the crop by his thinning or other operation. That one factor might be enough to keep the owner in high spirits right through the job, but we cannot expect it to stimulate the hired help in the same degree. Personal accomplishment, even in so uninteresting an operation as thinning apples, is something to take a pride in, especially if the boss knows about it and expresses his interest in it.

3. Supervise the beginning and quitting of the men each day. See that they get on the job promptly in the morning and at

noon, and that they do not come drifting in ten or fifteen or twenty minutes before quitting time. This is a rather difficult matter to handle, particularly on the smaller farms, but is a great deal more important than is generally recognized. If the time lost in beginning late and quitting early were accurately kept track of it would be an eye opener to most farm employers, and the aggregate of it in the United States in any one year would be enough to build the Panama Canal several times over.

4. Do not get too many men on any one job, and no matter how many men there are on the job, see that the work is so arranged that each man can be held responsible for what he does or does not do. If the job is picking apples do not put a half dozen men on a tree. They will get in one another's way, and nobody can be found to shoulder the responsibility for the apples in the barrels that had the stems pulled out, or the fruit spurs that were harvested along with the apples. Moreover, there is no way of keeping any reasonable track of the amount of work that each man is doing. If each man is working on a separate tree he gets the credit for the good work he does; he finds it difficult to dodge the responsibility for any poor work he may do, and the boss knows just how much work each man accomplishes. Here, again, the element of pride in one's accomplishment plays an important part, and very few men will be found who will be content to lag behind on their row of apple trees, or have the boss find more fruit spurs and fewer apple stems in their barrels than he does in the other fellow's.

5. Study your men and put each one on the job he is best fitted to do. There is a wide difference in the capabilities of different men for different work; one is a star with a team, another is a star on pruning, a third can do better spraying than anybody else, while a fourth cannot do anything particularly well. In this connection do not take it for granted that because a particular man has become expert on one job, and another on another job, that therefore both have found their proper niche in the scheme of farm work. To give a personal illustration, on the farm in which the writer is interested we had two men, one of whom ran the tractor and the other

was the salesman. Each was considered an excellent man for his particular job, but the huckster was considered a wonder. He could sell more fruit at better prices than any man who had ever undertaken the work. But he finally became indispensable (in his own opinion), and it was necessary to get rid of him, greatly to the regret of the management. The tractor chauffeur was the only available man to take his place. He was put on the job with fear and trembling. There was not one chance in a hundred that he would get away with it, nor one chance in a thousand that he would be equal to the indispensable Mike. His administration started just as the last of the Yellow Transparent apples were being marketed. They were not quite as good a grade as those that had gone before, yet this inexperienced tractor driver sold them for somewhat better prices than his expert and experienced predecessor had been able to get. It developed that he was not quite as inexperienced as we had thought him, for he had sold apples for an employer down in Connecticut, and onions and garden truck in a small way on his own hook. He has gone on improving until now he could give the expert Mike many pointers. He is less picturesque and profane, but more polite and persevering. He can see a dollar just as far as Mike did, and is even more certain of getting it.

6. Do not let the men be too fussy about what kind of weather they get out in. Of course this can be pushed too far till the men get ugly and won't work satisfactorily, but if they have been handled so that they are interested in what is going on they will be quite willing to take an occasional light shower of rain or some snow without thinking that they must run to cover.

Turning next to the questions of the management of team labor on the farm we find almost as fertile a field here for reforms. One of the first and most important of these reforms is to change the mental attitude of the owner on the subject of the use of teams. Ninety-nine men out of a hundred regard the team just as they do the ice pond or the well, — as something useful and necessary to the most successful carrying on of the farming operations, but as something which may be used or not, just as may be found convenient. They would no more

feel that it was a reflection on their farming that they did not keep their teams busy, than they would that they did not keep somebody constantly at work pumping water out of the well.

Of course this attitude is dead wrong, but most men do not sée it or, if they do, they do not "let on." If they could be made to realize that the cost of their team labor would be just half as much per day if they would use the teams twice as many hours it would be not merely a change but a revolution. The team ought not to stand idle an hour, if this can possibly be avoided. If it cannot be used at home it ought to be hired out. It cannot, of course, on most farms, be kept at work ten hours a day for six days a week for fifty-two weeks in the year, but that ought to be the ideal. One thing which will help to realize this ideal is to do every piece of work possible on the farm with teams instead of men. Few farmers realize how much more costly man labor is than horse labor, else we would see more corn fields that were check-rowed so as to be cultivated both ways, and fewer that had to be hoed by hand.

Another great saving in cost might be made if our teams were made to carry a full-sized load. How often one sees a fine team and one or more apparently able-bodied men coming in from the field with a mere handful of hay on the wagon, or going *out* to the field with a wheelbarrow load of manure. And yet this method practically doubles the cost of the labor item. If possible have the teams go loaded both ways. This is perhaps not very often possible, but it could be done much more frequently than it is if a little thought were put on the matter.

Lastly, on this matter of teams, do not put but one man on the job, unless it is such work as hauling hay or loading barrels of apples, where two men are absolutely indispensable for the man labor involved. The sight of two husky men and one team running a cultivator or a plow is enough to shake one's faith in the evolution of man, at least those particular men. There is something wrong with the man who cannot hold a plow and drive a team at the same time. He is a cripple, either mentally or physically or both, although he may not know it. The old saying ought to be amended to read, "He that by the plow would thrive, must always hold the plow *and* drive."

Another great field for reform which is frequently entirely overlooked is the adequate and careful preparation beforehand for each particular job, and the longer beforehand the better. Too many of us do not discover that there is a broken casting on the mowing machine until we drive out into the hay field with it in July and start to mowing. This ought to have been discovered way back in February or March, and the repairs ordered then. We order our apple barrels in September, when they are harder to get and cost us more than they would have in May or June. We discover in March that the power sprayer is out of order, when we ought to have found that out in November, and have had the engine expert give it a thorough overhauling. Another phase of the same question is preparing one day for the work of the following day. If planting corn is the job, we must not only see to it that the corn-planter is in working order, but we must be sure that there is a neck yoke and set of whiffletrees on it; that the oil can has not been borrowed from it and not returned; that there is a monkey-wrench in the tool box, and that the seed corn is ready. Unless some thought is put on just such details as these we are pretty sure to get out in the field and find something missing and have to return to the house for it. An old neighbor of the writer's out in Kansas used to remark, when he had to go back to the house after a clevis or a wrench, "Well, he who has not brains has legs;" and more than one of us has to depend a good deal on our legs. It makes a vast deal of difference in the work accomplished during the day whether we get on the job in the morning at the drop of the hat, or whether it takes us till 9 o'clock before things are really in running order.

One ought also to have a special list of work for rainy days and parts of days posted up somewhere or carried in the hip pocket, so that it is ready at a moment's notice. A good many days' work is lost on the average farm in the average climate because the boss does not know what to put the men at when a sudden shower stops haying or spraying. Some loss is inevitable, but most of it could be avoided by a little forethought.

Another point worth considering, though of less importance than the last, is the shifting of men and teams from a job that

is finished to a new one. Do not move them any further than is absolutely necessary in any one half day, but try to hold them in one part of the farm until quitting time, even though they do have to be put for a time on to work which is not quite so pressing as some job on the other side of the farm.

Then just a personal word to the boss himself. It is a big undertaking to run a farm competently, even if it is a small farm. In fact, in some ways it is a bigger job to run a small farm than a big one. But in any case it is a job to take pride in and to put one's best thought into. If things are to be made to go right one must get over the farm frequently, — if possible every day, certainly every week. It does not take long for the red-humped caterpillars to ruin an apple tree, or for the blight to get a start in the potato field, or for the peaches to get too ripe to handle well. In these inspection trips do not be too much of an optimist. Be critical. It is all right to see that the corn has grown a lot, and to be pleased by that fact, but at the same time see that the weeds are getting a start and that the field needs to be cultivated again.

Above and beyond all else keep the work moving. Keep the quality of the work high, too, but do not let the speed slacken. Hustle things.

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 9

April, 1919

CONTROL OF THE PRINCIPAL INSECTS INJURIOUS TO THE APPLE ABOVE GROUND

THOMAS J. HEADLEE

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

CONTROL OF THE PRINCIPAL INSECTS INJURIOUS TO THE APPLE ABOVE GROUND.

THOMAS J. HEADLEE, PH.D., ENTOMOLOGIST, NEW JERSEY AGRICULTURAL EXPERIMENT STATION.

Introduction.

In the discussion which follows, an effort will be made to treat of the species concerned and the operations for their control in the order in which they occur during the growing season. Throughout this discussion it is assumed that we are dealing with a bearing apple orchard. It must be remembered, in considering the recommendations set forth, that they are based on the writer's experience in New Hampshire and New Jersey, and that while they probably apply pretty well to Massachusetts conditions there is a possibility that some of them may not fit entirely the local conditions.

First Treatment.

It is possible, with our present knowledge, to say that the first spraying which the apple orchard should receive should control San José, oyster-shell and scurfy scales, and the rosy, the green and the oat aphis. In the past it has been customary to recommend a dormant treatment for the scale insects, and a growing season treatment for the plant lice.

About four years ago the New York Agricultural Experiment Station at Geneva came out with a recommendation that an effort should be made to kill the plant lice just as the buds are opening, and to combine this treatment with the ordinary dormant spray. The past three years' experience in New Jersey has confirmed this idea, and shown that it is possible to combine this treatment for plant lice with the ordinary dormant

treatment for scale insects, and with a single spraying operation to bring all of them under satisfactory control.

The treatment for controlling the scales and plant lice should be made between the time that the development of the buds show silvery and the time that the small leaves stick out from them like squirrels' ears. This description refers to the fruit buds and not to ordinary leaf buds. In the studies at the New Jersey Agricultural Experiment Station it has been shown repeatedly that not all lice have hatched by the time this stage has arrived, but it has also been shown that the eggs which are still unhatched have split their outer covers and have become very susceptible to destruction by spraying mixtures.

When the number of aphis eggs is extremely large, such as is the case this year (1919) in New Jersey, so many of the eggs may be tucked in under the buds out of reach of the spray that a considerable number of aphids may appear after this treatment has been completed. The orchardist should keep a close watch. If this happens he should immediately re-treat his orchard with a mixture of 40 per cent nicotine, water and soap, using 1 part of the nicotine to 500 parts of water (three-fourths of a pint to 50 gallons), and adding soap (whale oil or laundry) at the rate of 2 pounds when water is soft, or 3 to 5 pounds when water is hard, to each 50 gallons.

Standard liquid lime-sulphur concentrate (testing 32° Beaumé) combined with water at the rate of 1 gallon to 8 or 9 gallons of water, plus 40 per cent nicotine at the rate of 1 part of the nicotine to 500 parts of the lime-sulphur and water, all things considered, has proven the most satisfactory mixture.

The writer realizes that there are on the market to-day a number of substitutes for the standard liquid lime-sulphur concentrate, such as dry lime-sulphur, soluble sulphur (sodium sulphur), B. T. S. (barium sulphur), etc., but, assuming that the efficiency of these substitutes is measured by their total sulphur content, believes that any one of them will cost at least twice as much as the standard liquid lime-sulphur concentrate, and will be no more efficient. It should be recognized that up to date none of them have had anything like the test which has been accorded to the standard liquid lime-sulphur concentrate.

The writer is also aware that the recommendation of 40 per cent nicotine at the rate of 1 to 500 (three-fourths of a pint to 50 gallons) is much stronger than that which has been recommended by many experiment stations and other agencies. His experience, covering at least the last three years in New Jersey, has, however, unmistakably shown that far better results follow the use of 1 to 500 (three-fourths of a pint to 50 gallons) than those which follow the use of the weaker mixtures.

In applying these mixtures for the control of scales and plant lice it is necessary that the coating of the trees be made as nearly absolutely complete as is practicable, for all are sucking insects, and must be hit in order to be killed.

The machinery advisable depends upon the labor factor. With high-pressure pumps and large delivery nozzles the coating may be obtained with a much shorter expenditure of time and labor, but an equally good coating can be obtained with lower pressures if time enough is taken to do the work.

It should also be said that this first treatment, containing as it does lime-sulphur, should have a destructive effect upon fungous diseases.

Second Treatment.

Between the time the small leaves project from the flower buds like squirrels' ears, and the time the trees come into bloom, apple scab infection is likely to take place, red bugs, canker worms and other leaf feeders to appear, and the forerunners of the plum curculio to make their appearance in the orchard. This period is therefore one during which something should be done to prevent injury by fungous diseases and insect enemies. When the buds begin to show pink the trees should be thoroughly treated with a mixture composed of 1 gallon of standard liquid lime-sulphur concentrate to 40 gallons of water, to which arsenate of lead has been added at the rate of $1\frac{1}{2}$ pounds of the powder or 3 pounds of the paste to 50 gallons. The whole tree should be well coated, but an especial effort should be made to see that the young flower buds and expanding leaves are well covered. The best coating is likely to be obtained by delivering the spray as a fine mist under high

pressure. A coarse spray is likely to run off the tree and to leave the critical parts of leaves and flower buds without the necessary protection, and may possibly do more or less harm through burning.

If red bugs are present 40 per cent nicotine should be added to this spray at the rate of 1 to 500 (three-fourths of a pint to each 50 gallons).

The question of machinery in this application is the same as that discussed in connection with the first treatment.

Third Treatment.

Beginning when the blossoms are three-fourths or more off the trees, and before the blossom ends of the apples have closed, there is a period of from five to seven days in which mixtures may be applied which will tend to protect the trees from codling moth, plum curculio, red bug, general leaf feeders, apple scab and other fungous diseases. At this period the arsenical poison may be placed in the blossom end of the apple, where it will remain throughout the season ready for the apple worm when it tries to enter the fruit through this door. The young fruit may be so thoroughly coated as to protect it from the attacks of the plum curculio, which will normally come a few days later. If the red bugs have not previously been destroyed they may be killed by adding to the ordinary mixture 40 per cent nicotine. At this time that coating which will protect the fruit and foliage from canker worms and other leaf feeders and fungous diseases for the next week or ten days may be made.

The mixture which is probably best is composed of 1 gallon of standard liquid lime-sulphur concentrate to 40 gallons of water, plus $1\frac{1}{2}$ pounds of powdered arsenate of lead or 3 pounds of the paste to each 50 gallons of the mixture. If red bug is to be fought, 40 per cent nicotine should be added to the mixture at the rate of three-fourths of a pint to 50 gallons.

The material should be applied as a fine mist. Effort should be made to give to the fruit and foliage a thorough coating, and especial attention must be given to coating thoroughly the spreading lips of the blossom end of the apple. Again, the question of machinery for applying is one which depends upon

the labor available. High pressures and large nozzles mean much saving in labor, but cannot be said in other respects to produce better results than relatively low pressures and small nozzles.

Fourth Treatment.

This fourth treatment is necessary only where the plum curculio normally stings a sufficient number of the apples to seriously damage the crop. It is based on the fact that the writer has never observed an instance in which the plum curculio has stung the fruit through a good spray coating. It is his observation that this insect hunts up the spots which the spray coating does not cover, and there does its work. In his experience the principal damage by the plum curculio occurs within a space of five or six days, and that in the past this damage has taken place in the period between the blossom fall and the next recommended spray. At this time the growth of the apple is exceedingly rapid, and the spray coating administered to it at the fall of the petals is quickly broken, giving the plum curculio every opportunity to find spots that are free from the spraying mixtures.

It is therefore recommended that this treatment be begun not more than one week after the blossoms fall. The material should be the same, with the exception of the nicotine, as that recommended for the blossom fall spray, provided, of course, that the varieties are not especially subject to russet. This question of damage by russeting will be discussed later in this paper.

The material should be applied as a fine mist, and both fruit and foliage should be very thoroughly coated. The machinery question here is the same as in preceding treatments, and needs no especial consideration.

Fifth Treatment.

Ten days after the fourth treatment, or approximately three weeks after the blossoms drop, the first brood of codling moth worms will begin to enter the apples. Inasmuch as many of the eggs of this insect are laid upon leaves at a considerable distance from the apples, with the result that the young worms

feed more or less on the underside of the foliage as they make their way toward the apple, and inasmuch as nearly 20 per cent of the worms which reach the apple will attempt to enter through the sides, it is necessary that both fruit and foliage be thoroughly coated at this time with a poisonous mixture. In view of the further fact that fungous diseases of one sort or another are always with us, it seems advisable to use a fungicide as well.

The mixture should in this case be the same as that recommended for the fourth treatment, and a special effort should be made to coat the under and upper sides of the leaves and all portions of the fruit with the material. The mixture should be applied as a fine mist, because in this way the most complete coating possible can be obtained. The machinery here is the same as in preceding treatments, and needs no especial consideration.

Sixth Treatment.

Eight or nine weeks after the blossoms fall the second brood of codling moth worms begin to enter the apples, and the coating given the trees five or six weeks before has almost entirely disappeared. Furthermore, the protection against fungous diseases has likewise gone with the disappearance of this coating. It is therefore necessary at this time that the fruit and foliage be recoated, the foliage primarily from the standpoint of protection from leaf feeders and fungous diseases, and the fruit from the standpoint of protection from the apple worm. The material used in this treatment should be the same as that recommended in the previous treatment, and it should be applied as a fine mist, with an especial effort to give to the foliage (particularly the upper side) and the fruit (all sides) a complete coating consisting of fine specks of the spray material. The machinery question is here the same as in the preceding treatments, and does not require especial consideration.

Special Treatments.

The apple maggot, or railroad worm, will probably in most cases, at least where clean orcharding is practiced, be taken care of by the above-outlined treatments, the flies being poi-

soned from licking up the globules of spray between the time they emerge and the time they lay their eggs. There may, however, be some cases in which, because of non-cultivation of orchards, and because of no effort to destroy the dropped apples, this insect may not be thus brought under control. Where such difficulty is anticipated the orchardist should take some of the infested apples of last year's crop, place them upon medium, moist soil in a box, and cover the open end of the box with wire mosquito netting. He should maintain the moisture of this soil by adding a little water from time to time. In due time the adult flies will appear in the box. Shortly thereafter, assuming that the box has been kept out of doors under outdoor conditions, he should apply to his trees a spray consisting of 4 pounds of powdered arsenate of lead to 100 gallons of water. In view of the fact that it is expected the flies will be killed by consuming the droplets of the spray liquid, it is probable that a spray slightly coarser than the one recommended in the regular treatments would be best. Ordinarily these flies appear in early July, almost coincident with the sixth spray of the schedule, but of course may not always do so. However, it is advisable that the orchardist practice, wherever possible, clean orchard culture, and depend upon the regular sprayings to take care of this insect.

The apple leaf hopper is an insect which may or may not appear in the orchard in any given year. It is therefore necessary for the orchardist to detect it after it has hatched and before it has reached the winged stage. This can be done by examining the under sides of the foliage from time to time, keeping a sharp watch for a small, slender, greenish white insect which is able to move rapidly over the leaves, but which cannot at this stage fly. When these insects are discovered the orchard should be promptly sprayed. If a regular spraying is due, simply add to the regular spray material 40 per cent nicotine at the rate of three-fourths of a pint to 50 gallons. If no regular spray is due, treat the trees thoroughly with a mixture composed of three-fourths of a pint of 40 per cent nicotine to 50 gallons of water, to which soap has been added at the rate of 2 pounds where the water is soft, or 3 to 5 pounds where the water is hard. In making these treatments especial pains

must be taken to coat the under sides of the leaves, for that is where the leaf hopper is usually found.

The bud moth, which is a small reddish brown worm that bores into the swollen buds, eats out their contents and later attacks the foliage, is usually not troublesome when the regular spraying schedule outlined in this paper is practiced year after year. In orchards where it is especially troublesome it may be necessary to make a special application of arsenate of lead just as the buds begin to expand. In that case about $2\frac{1}{2}$ pounds of the powdered arsenate of lead should be used to each 50 gallons of water, and an especial effort made to coat the buds with a fine misty spray. Possibly something could be done by adding lead arsenate to the first treatment at the rate of $2\frac{1}{2}$ pounds to 50 gallons.

Russetting and burning Apples with Spraying Mixtures.

Some varieties of apples, such as Williams, Ben Davis and Grimes, are easily russeted with lime-sulphur at summer strength. In our experience apples may be russeted by material applied when the buds show pink, and when the petals fall or later. It is suggested that growers who have varieties especially susceptible to russeting and that are rarely troubled with scab use self-boiled lime-sulphur as a substitute for the applications recommended in treatments 2 to 6 inclusive. Furthermore, self-boiled lime-sulphur has been found to be very effective in stopping the ravages of the rose bug.

When lime-sulphur, summer strength, is applied to apples under high temperatures, especially if applied very heavily, it is likely to produce a most serious burning of the apple fruit. This type of burning is one which the apple does not readily outgrow. The writer has seen enormous damage done in this way. It is the writer's experience that Bordeaux mixture, which is sometimes used in place of lime-sulphur in sprays recommended in treatments 2 to 6 inclusive, is very likely to russet and burn in wet weather, while lime-sulphur is very likely to russet and burn in hot dry weather.

Liquid v. Dust.

We now have data bearing on the question of the use of dust mixtures for control of fungous diseases and insects which are derived from a period of about six years. Dust has not been able, apparently, to control plant lice, red bug, leaf hoppers, scab or other fungous diseases in a way to compare at all favorably with liquid applications. Dust can, therefore, not be recommended as a substitute for liquid applications on apples.

Substitutes for Arsenate of Lead.

Calcium arsenate and other recent combinations of arsenic with minerals, other than lead, have been placed on the market at figures which make them, on the basis of equivalent amounts of arsenic, much cheaper than arsenate of lead. Calcium arsenate and such others as the writer has examined apparently break down much more quickly than lead arsenate, and are therefore less safe for use on the foliage and fruit of apple trees, which are not tolerant of arsenic as are potatoes and tomatoes.

The Commonwealth of Massachusetts

DEPARTMENT OF AGRICULTURE

ARTHUR W. GILBERT, Commissioner

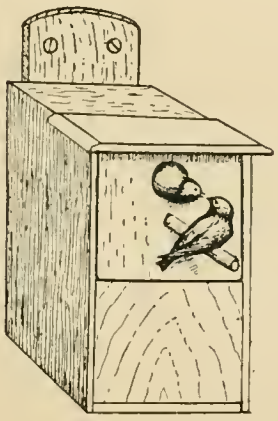
DEPARTMENT CIRCULAR No. 10

Second Edition, Revised

August, 1920

BIRD HOUSES AND NESTING BOXES

EDWARD HOWE FORBUSH



BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

8-20-4,500

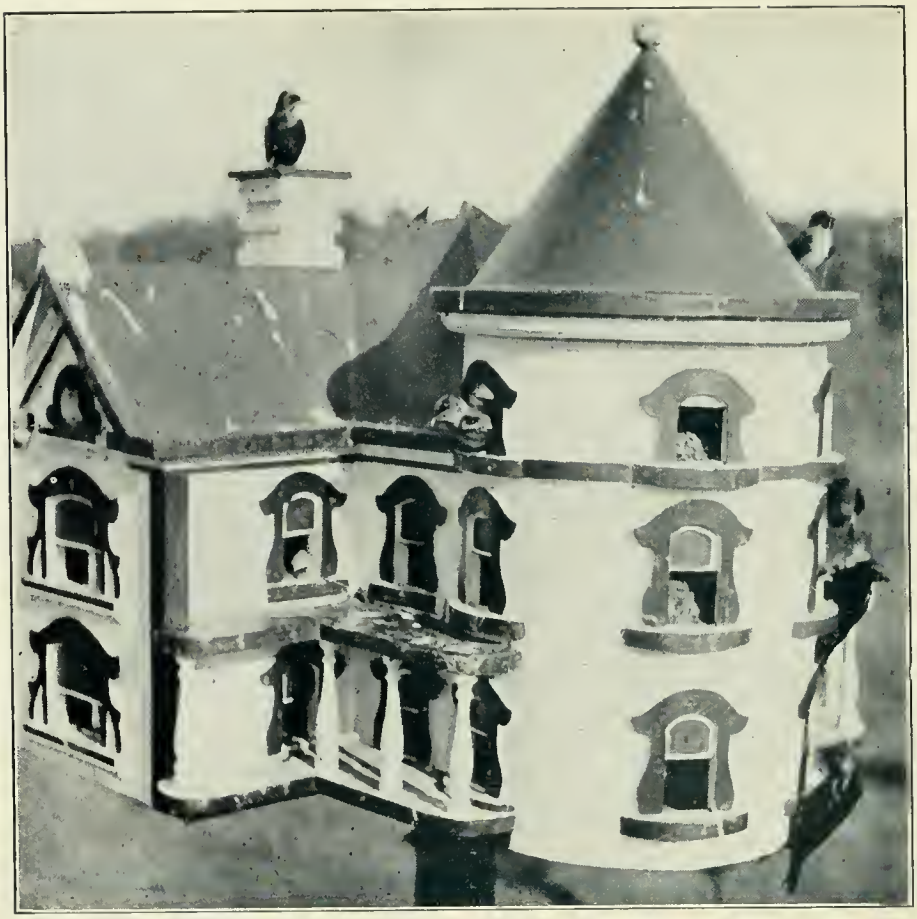


Fig. 1. — Martin box, made by Mr. J. Warren Jacobs of Waynesburg, Pennsylvania. This forms part of a nesting colony on the estate of Mr. Edward L. Parker at Concord, Massachusetts. (Original photograph.)

Wellesley Bird Box.

Fig. 2. — This is both inexpensive and effective. Note entrance guard of galvanized iron. The roofing felt overhangs and turns down, making a tight roof. (Photograph by John C. Lee. See page 7.)

CONTENTS.

BIRD HOUSES AND NESTING BOXES.

EDWARD HOWE FORBUSH, DIRECTOR, DIVISION OF ORNITHOLOGY.

Introduction.

Many people fail to put up bird houses or nesting boxes because of the trouble and expense entailed, or because they do not know how to prepare and erect them in such a way as to get the birds. Much that has been written on this subject has been theoretical. Fatal errors in the dimensions of entrances have been disseminated. For want of specific instructions, nesting boxes have been put wrong side up or in places where no bird would use them.

This circular has been written to encourage people to construct easily made, inexpensive nesting boxes, and to tell when, where and how to put them up so that the birds will be sure to take them. Making and putting up such boxes should be looked upon as a pastime. They need cost little or nothing, and he who makes them should feel well rewarded by the joy of seeing the little tenants choose, settle down, build their nests and rear their young, singing their cheery songs meanwhile, and feeding on the insect enemies of crops and trees. We must provide homes for the birds that nest in hollow trees, as there are no longer holes enough for all, while destructive insects have so increased in numbers that the food supply is abundant.

Numerous nesting boxes properly put up will increase rapidly the number of birds in a locality by multiplying the bird families reared. I have known more than 100 young birds of four species to be reared in a single season in nesting boxes on about 3 acres, where no birds of these species were raised in previous years, and where none could have been reared previously as they then had no suitable nesting places. Boxes rightly made and situated give much better protection to the young than do most tree cavities. A bird box is serviceable if it furnishes a suitable nesting apartment, shelters nest, eggs and young from sun, wind and storm, and provides security against the

birds' enemies; also it may serve in winter as a night shelter or sleeping place for a woodpecker or a party of nuthatches or chickadees. We must allow the birds to be the judges of what they want, as they and not we are to be suited. Therefore in building a nesting box it is well to inquire first what kind of a home the bird naturally chooses.

General Considerations.

Many people write me anxiously asking of what size nesting boxes should be made and begging for exact dimensions; some are unhappy lest the entrance holes face the wrong way; others are anxious about ventilation; others feel sure that the smell of paint on the nesting boxes or bird houses will drive the birds away, while still others fear that they may get the box too high or too low; but all these things make very little difference. The situation and environment, and the size of the entrances, however, are important. I have known tree swallows to nest in a round box $3\frac{1}{2}$ inches in interior diameter, in a flowerpot even smaller at the bottom, and in a one-apartment bird house, nearly a foot square and about 18 inches high from floor to ridgepole (Fig. 1). This is one of the most popular houses with tree swallows. But why waste enough lumber on one bird house to make three nesting boxes? I have tried facing the entrance hole to all points of the compass. The birds used them all.[1] Painted or unpainted, weathered or unweathered, wood, bark, cement, tin, clay, papier-maché and roofing felt, — all have been chosen indiscriminately by feathered house hunters. Boxes placed 6 feet from the ground and others set on poles on the roofs of tall city buildings have been taken. I have seen chickadees nesting in a hole in a birch stump 2 feet from the ground and in the hollow branch of an elm 65 feet high. One wood duck settled in a hollow apple tree 3 feet from the ground, and another 40 feet up in a hollow elm. Such ex-

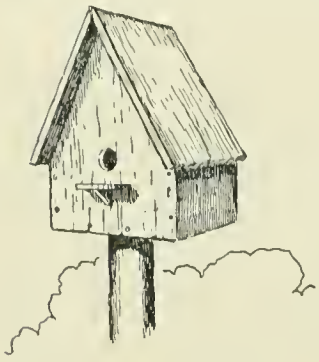


Fig. 1. — Swallow house.

[1] I am now convinced, however, that in New England it is best to have the entrance holes face generally in a westerly direction. Only warm rains drive in from the south, but occasionally the southern storms are very severe.

periences lead us to revise our opinions regarding the exact size of the tenement each bird requires and how high or low it should be situated. I am not so positive as I once was regarding what is best for certain species or what kind of a box or situation will please each one best. It seems that the birds have some individuality, or that they need nesting places so badly that they will take almost anything if it is so situated that it offers peace and safety. Nevertheless, there are a few rules that should be followed in making and erecting bird houses to secure the best results.

Important Specific Directions.

1. Let the roof be made tight and overhang the entrance far enough to carry rain clear and keep the sun from shining in on the young.

2. Do not make the bottom of the box too tight. If any rain drives in, it should run out.

3. If the box tips forward a little on the side of the entrance hole when set in place it will shed rain well. It should never lean backward.

4. Provide a way of *opening the box quickly,* even if you intend to burn it and replace it after the first season, as is done sometimes with gourds and shingle or bark boxes. It will be necessary from time to time to open the box for cleaning or for evicting gypsy moths and other pests or vermin.

5. Make the entrance hole and the box itself just large enough for the bird you want — no larger. This will tend to keep out larger birds, as well as the birds' enemies, will give the bird a better chance to defend its home, and will save material.

6. Entrances to nesting boxes should be protected against enlargement by squirrels or woodpeckers by tacking on the outside a ring of sheet zinc, cut to fit around each hole. (See Plate I, Fig. 2.)

7. Make nesting boxes of weathered wood, or paint or stain them with colored linseed oil of a neutral tint resembling dead wood or bark, or put them up in the fall that they may become weather-stained before spring. Apparently birds are less suspicious of such boxes than of those made of new, bright lumber, but they have been known to use the newest of the new.

8. Fix nesting boxes on buildings or on poles rather than on trees, and make them inaccessible to cats, squirrels, mice, rats and snakes.

9. Where it seems best to put them in trees, choose isolated trees which can be protected against cats, squirrels, weasels, etc.

10. Ordinarily ventilation is unnecessary if the entrance is near the top of the box as it should be, but in very hot summers young birds are believed to have died of heat in unshaded boxes mounted on poles. Ventilation may be provided by boring 4 half-inch holes in the sides of the box near the top and filling them with corks which may be removed in extremely hot weather.

11. It is best to clean out the boxes each autumn, burning the old nesting material to destroy dirt and vermin, and putting in a little chaff, dry grass or coarse sawdust as a foundation for a new nest.

A few practical details in regard to carrying out some of the above rules should be noted.

If the roof of a nesting box, made of wood, is horizontal, the water will stand on it, and even if painted it will warp somewhat in drying unless heavily coated with good roof paint, or covered with zinc, some good roofing felt or other waterproof material. It is well to have a crosspiece nailed (with clinch nails) across the grain on the under side to prevent warping and splitting. If the top slopes downward at an angle of 45° or less and is well painted, the water will run off so fast that the roof will not warp much.

Top, side or front of the box may be hinged to open as a door, or fixed to fasten by means of nails, easily removed, slid loosely into sockets bored for them. White pine from $\frac{1}{2}$ to $\frac{7}{8}$ of an inch thick is the best lumber. Cedar and cypress are durable. Grocery or drygoods boxes may be used.

Hollow Limb Nesting Box.

As the hollow trunk or limb, or the abandoned woodpecker's nest, is the usual domicile chosen by the hole-nesting birds, it is natural to conclude that they will prefer something closely resembling nature's accommodations. For this purpose a section of a tree, containing an old nest of a woodpecker may be

taken, or hollow limbs, pruned from apple or other trees, may be sawed into sections about a foot in length, the lower end of each plugged, and the upper end covered with an overhanging piece of board sloping to the front. A hole may be bored in the front of this contrivance for an entrance, and a piece of board may be nailed on the back (Fig. 2), so that the box when finished may be screwed or nailed to a post or pole. *Nesting boxes should not be nailed to trees,* as after the birds have left them they serve as hiding places for gypsy moths and receptacles for moths' eggs; also if nails are driven into a tree they may in time be overgrown by the wood and become dangerous obstacles for axe or saw when the tree is cut up. The hollow of the limb should not be less than $3\frac{1}{4}$ to 4 inches in diameter at the bottom, and 6 to 8 inches in depth below the entrance. The deeper the box, the longer the overhang of the roof, and the higher the hole the less chance there will be for cats and the other large enemies of birds to reach the eggs or young. Perches are not necessary. Some birds like them, but they give the enemies of the birds the advantage of a better foothold.

Fig. 2. — Hollow limb.

Log Nesting Box.

Ernest Thompson Seton recommends the following plan: —

A nesting box may be made of a stick of wood or a section of a small log by first splitting off four slabs with an axe and then nailing in at each end a section sawed from the core that is left after the slabs are split off. A hole may be bored for an entrance for the birds. (See diagram, Fig. 3.) This box may be quickly made of white pine, chestnut or cedar. A section without knots should be chosen.

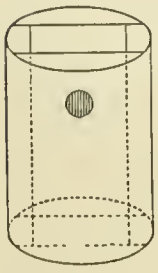


Fig. 3. — Seton box.

Bark Nesting Boxes.

Neat boxes may be made of slabs with the bark on (Fig. 4), or a rough box may be covered with bark in place of paint, but all bark left on bird houses should be firmly nailed on, as otherwise it will come off sooner or later. In "Bird-Lore" for

January–February, 1905, I described the method of making bark boxes, but at that time they were untried. They have been used since with satisfactory results. The credit of their invention belongs to Mr. William Brewster, and I have made a considerable number after his design. Canoe birch and chestnut were used, as it was believed that the bark of these trees would be most durable, but Mr. Brewster suggests that elm bark is probably best of all.[1] Those portions of the trunks used were from 4 to 8 inches in diameter. The boxes were made in summer, as the bark will not usually peel freely much earlier than June 20, and then only for a short time. When the tree had been cut down, the trunk was sawed into sections each from 10 to 18 inches long, according to the size of the boxes desired. Only straight sections, free from knots or branches, were used. A limb of the right size, however, may, when cut off, leave a hole in the bark that can be utilized as an entrance for the birds.

Fig. 4 — Slab box.

Fig. 5. — Chestnut bark box.

These domiciles may be made as follows: an incision, through both outer and inner bark, is made on the side intended for the back of the box, from the top to the bottom of each section; then, on the opposite side, 2 inches from the top, there is bored through the bark, with an auger or extension bit, a hole of the size desired for the entrance. If such tools are not at hand the aperture may be cut with a gouge, a chisel or even a knife. Next, a wedge-shaped stick is inserted into the incision at the back and under the inner bark, to start it off, and with this implement it is peeled very carefully. In peeling birch one should be careful not to separate the inner and outer layers of the bark. Caution should be used when working about knots or rough places. The bark will make the sides of the box, and two sections, each an inch thick, sawed from the ends of the barked log, will make the top and bottom. Now the bark is

Fig. 6. — Birch-bark box.

[1] The bark of the common gray or so-called "white" birch is not very durable, but that of the northern white or canoe birch is more satisfactory.

PLATE II.

Fig. 1. — A nesting box made from roofing felt by Mr. Winthrop Packard of Canton, Massachusetts. (Original photograph taken on farm of Mr. William P. Wharton, Groton, Massachusetts.)

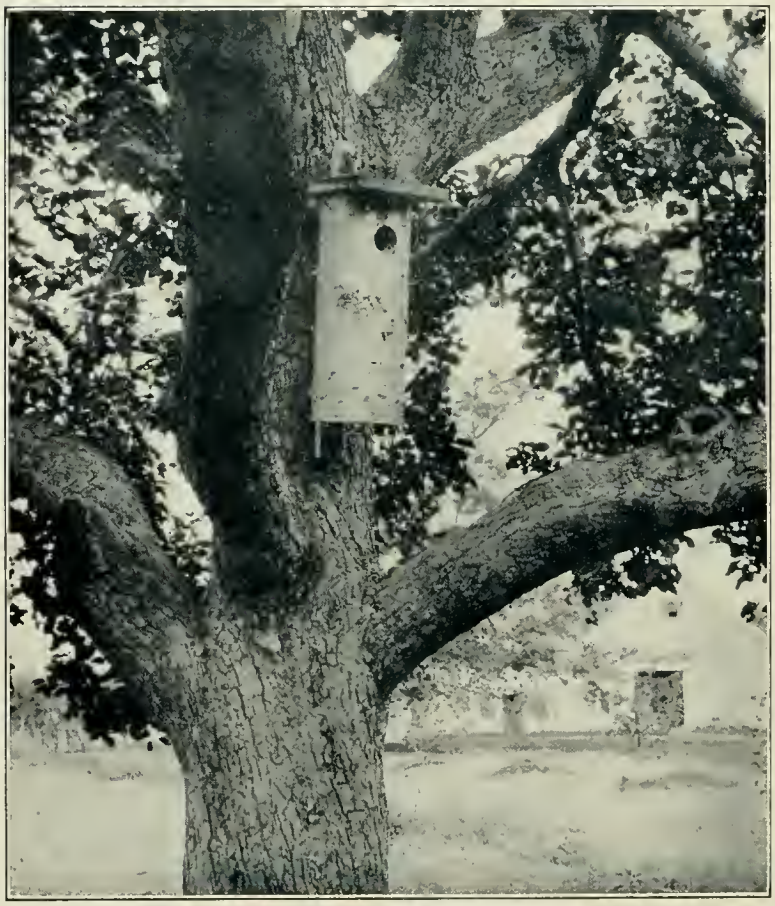


Fig. 2. — Berlepsch nesting box, made of birch after the plans of Mr. Ernest Harold Baynes of Meriden, New Hampshire. This style has proved acceptable to woodpeckers and nuthatches. (Original photograph taken on the farm of Mr. William P. Wharton at Groton, Massachusetts.)

tacked to the bottom and top. The bark will draw apart somewhat at the back in drying, but this aperture may be covered, when the box is put up, by nailing or screwing a short stick or pole over the opening on the back, which stick in turn may be nailed or screwed to the supporting building or pole. To make the roof watertight, a piece of cotton cloth, duck or denim may be put on, tacked down over the edge and painted, or a piece of roofing paper may be used. A more permanent covering may be made by using a piece of tin or zinc, as shown in the figure of the chestnut bark box (Fig. 5). To make the expected nest accessible to examination, the top of the bark sides might be fastened to a hoop, and the whole capped by a tin or wooden cover, like that of a lard pail or a berry box. Mr. Winthrop Packard makes a very pretty box of roofing felt. (See Plate II, Fig. 1.) The best support is a slim pole.

Conductor Nesting Box.

Large wooden conductors, used to carry water down from the eaves of large buildings, may be obtained from some dealers in lumber or moldings, sawed into sections, and utilized precisely as in the case of hollow limbs.

Berlepsch Nesting Box.

Baron Hans von Berlepsch of Thuringia has invented a device for making nesting boxes similar in shape to the nesting holes of woodpeckers, and he has been wonderfully successful in attracting all hole-nesting birds of that region to these boxes. (Fig. 7 and Plate II, Fig. 2.) The theory on which they are built is admirable, but after ten years' trial of them in this country I am convinced that most Massachusetts birds do not prefer them to the hollow limb or even to the rectangular box (Fig. 8) that many people have used with great success. The Berlepsch style of box may

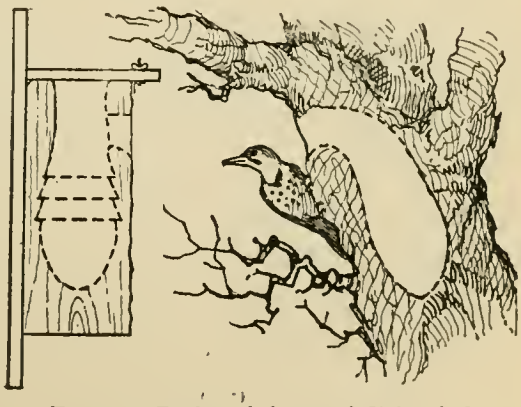


Fig. 7. — Berlepsch box and flicker hole.

be better for typical woodpeckers, such as the hairy and downy woodpeckers. Mr. Ernest Harold Baynes reports two cases where downy woodpeckers have nested in these domiciles; but flickers and red-headed woodpeckers nest in rectangular boxes. This latter type of box is excellent for bluebirds, chickadees, wrens, flickers and tree swallows. If made 18 inches deep for bluebirds it will be very nearly cat proof. The smaller sizes of the Berlepsch type have been made and sold in Germany for about 25 cents each, but here they cost much more. A very fair temporary substitute may be made by growing gourds which, when the contents have been removed, are acceptable to many birds if tied upon poles or trees (Fig. 9), but they are not so durable as well-made wooden boxes, and I have not had much success with them.

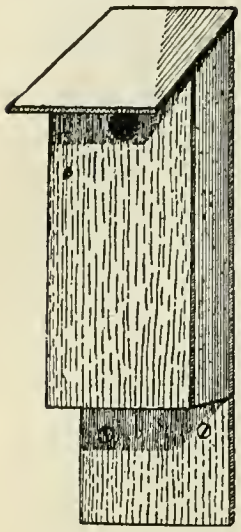


Fig. 8. — A useful box.

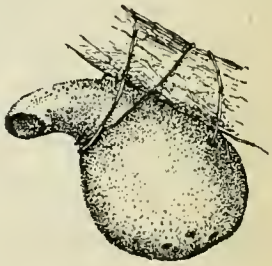


Fig. 9. — Gourd.

Shingle Nesting Box.

My first nesting boxes, all of which were successful, were made of old shingles, picked up from the ground when the barn was reshingled, and some pieces of old weathered boards removed from the ridgepole at that time. A square section about $3\frac{1}{2}$ inches in diameter was sawed from the ridgeboard for the top of the box, and another 4 inches wide was used for the bottom, the shingles being nailed to them (Fig. 10). A saw, hammer and jacknife and a few nails were the only tools and materials required. I have made such a box in twelve minutes. These boxes were nailed up in elm, cherry and apple trees, and some happy families of bluebirds were raised, until at last the cats discovered them. A large number of shingles may be saved when a building is reshingled, and every year at the end of the season the old boxes may be taken down and burned, to do away with vermin, gypsy moths, etc., that may be concealed within. It takes but a short time to make more.

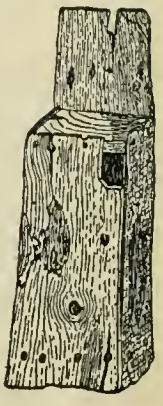
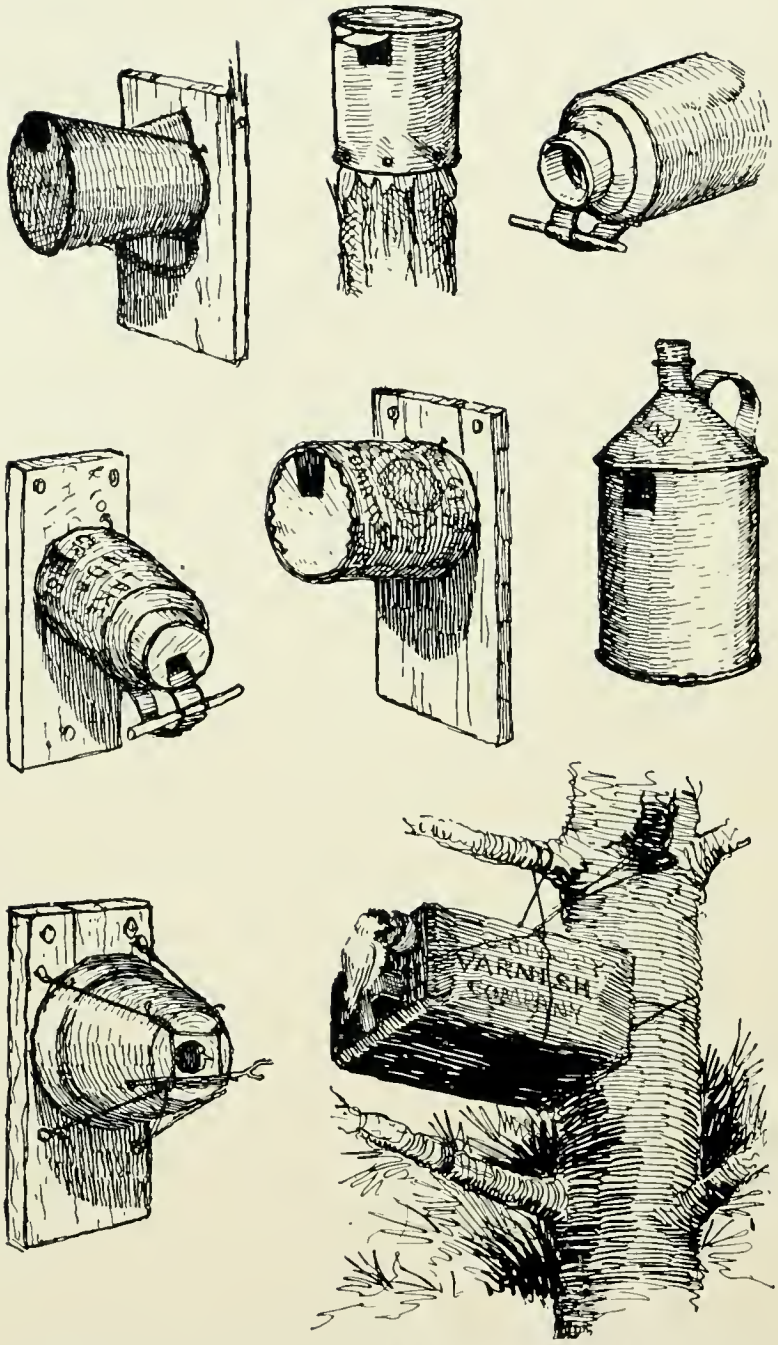


Fig. 10. — Shingle nesting box.

PLATE III.



Worn-out cans and utensils for nesting boxes. They may be nailed to posts or wired to trees, and should be so placed as to be shaded from the sun in the hottest part of the day.

Tin Cans, Flowerpots, etc.

Tin cans and flowerpots are not quite so suitable for nesting boxes as are wooden receptacles, because pottery and metal are good conductors of heat, and unless put up in the shade are likely, in very hot weather, to overheat the young birds. Nevertheless, if such utensils are placed where they will be in the shade during the hotter part of the day they may be used with success (Plate III). Cheap, thin boxes, such as the larger cigar boxes, may be fastened up inside a barn under the eaves and a hole bored through the wall of the building into each box, or a box may be made for this purpose (Fig. 11).

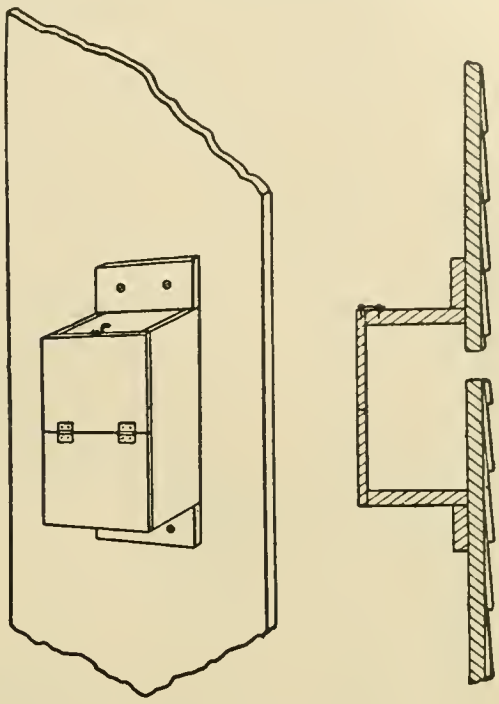


Fig. 11. — Box inside a building. (From Biological Survey.)

Dimensions of Nesting Boxes.

The following dimensions will do for flat-roofed dwellings for the birds named. These dimensions are not absolute, but are such as seem to be popular with the birds. The boxes may be made larger if desired, but not very much smaller. The size of the entrance, however, should not be changed. If the roof is not level but slopes forward the back may be two or three inches higher.

House Wren. — Interior dimensions, 6 by $3\frac{1}{2}$ by $3\frac{1}{2}$ inches. Entrance hole, $\frac{7}{8}$ inch in diameter. Of course a wren will use a box with a larger entrance, and some people prefer $1\frac{1}{2}$ inches, as they believe that the wren can more easily carry the sticks of which its nest is largely made through this larger opening, but if the small entrance is used English sparrows and other birds cannot get in and molest the wrens. The long axis may be either horizontal or vertical and the entrance hole near the top. A miniature bird house (Fig. 12) will do as well, but takes more time to make.

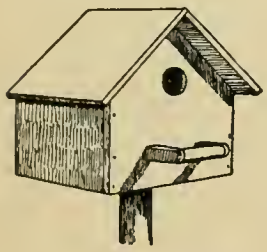


Fig. 12. — Wren house.

White-breasted Nuthatch. — A box actually occupied by this bird in 1914 measured 5 by 5 inches (inside dimensions). Height 12 inches front; $13\frac{1}{2}$ inches back. Entrance front, near top, $1\frac{1}{2}$ inches in diameter (Fig. 13). Mr. J. T. Mellus of Wellesley writes that this species has nested there in a bird house with double-pitched roof, and the long axis horizontal. The dimensions were 8 inches long, 6 inches wide, and 7 inches high. The entrance was $1\frac{1}{2}$ inches in diameter and about 4 inches above the bottom. A small platform was made just below the entrance, and the house was fastened to an electric-light pole about 18 feet from the ground, facing the east and 8 feet from a brick building. Probably a box made of bark, or slabs with bark on, would attract this bird.

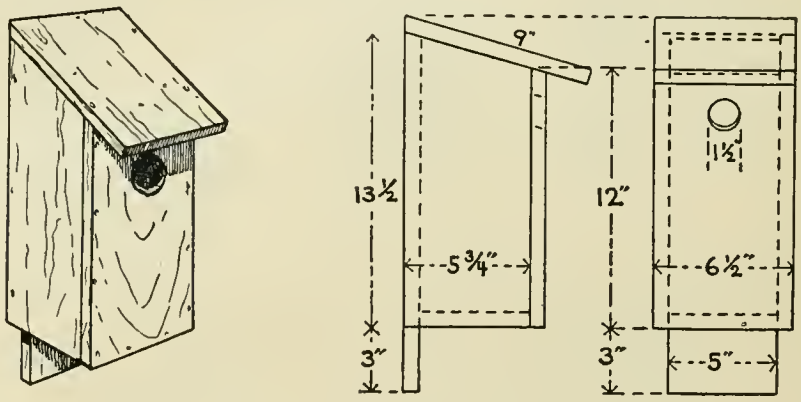


Fig. 13. — Box used by white-breasted nuthatch.

Red-breasted Nuthatch. — This bird has nested in a No. 2 Berlepsch nesting box made of yellow birch by the Meriden Bird House Company, Meriden, New Hampshire, and placed in a gray birch tree, in rather open land, with the entrance slightly more than 7 feet above the ground. The entrance hole is $1\frac{1}{8}$ inches in diameter.

This is reported by Mr. H. S. Shaw, Jr., of Dover, Massachusetts, and is the only case, so far as my records show, where a red-breasted nuthatch has nested in a bird box.

Chickadee. — A box like Fig. 8 or Fig. 14 may be used, 10 by 4 by $3\frac{1}{2}$ inches inside dimensions. Long axis vertical. Entrance hole $1\frac{1}{4}$ inches diameter, placed near top of box. Others recommend an entrance $1\frac{1}{8}$ inches in diameter, or less, but my experience goes to show that our chickadee, like the European titmice, prefers an opening a little larger than it needs, which

PLATE IV.

A nesting box occupied by the crested flycatcher. This is not the box referred to on page 16, but another, used later by the same birds. (Photograph by Mrs. J. W. Elliott, Needham, Massachusetts.)

makes the chances of success better with the larger entrance. Many boxes for this bird have been made with the entrance too small. They are rarely if ever used.[1]

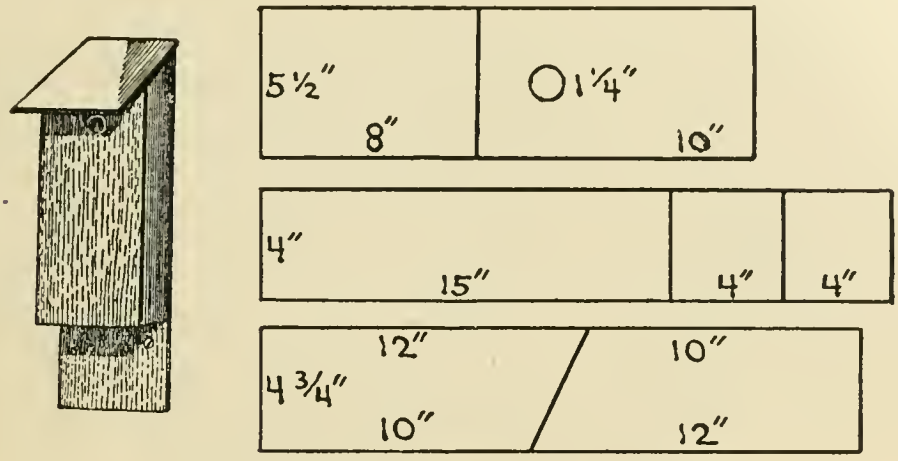


Fig. 14. — Chickadee box and details of construction.

Bluebird. — Interior dimensions, $4\frac{1}{4}$ by $4\frac{1}{4}$ by $9\frac{1}{4}$ inches. Entrance, $1\frac{1}{2}$ inches or an eighth less — never $1\frac{1}{4}$ inches, as most bluebirds will not enter a hole of this size. Long axis vertical (Fig. 15). Tree swallows will use this.

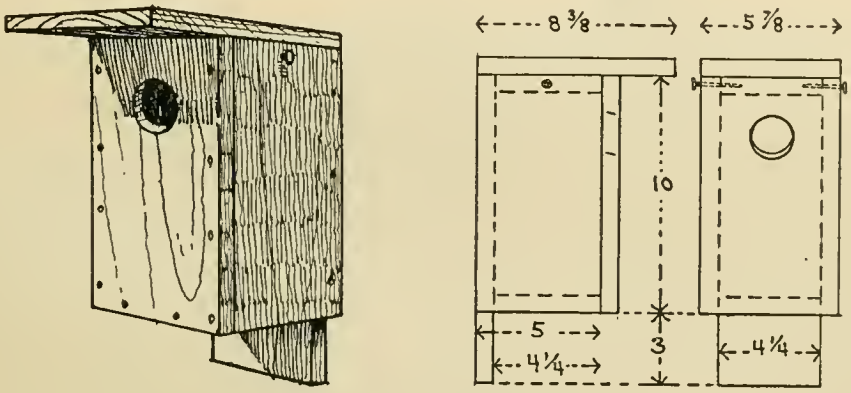


Fig. 15. — Bluebird box and details.

Tree Swallow. — Interior dimensions, $4\frac{1}{4}$ by $4\frac{1}{4}$ by 8 inches. Entrance hole about, not over, $1\frac{1}{2}$ inches. Long axis vertical. Bluebirds also use this box.

This is the most popular box (with the birds) that I have seen.

[1] In May, 1915, I saw in Lenox a pair of chickadees feeding young in a nesting box with a round entrance hole 1 inch in diameter. In 1916 another pair nested at Wareham, in a box with a 1-inch entrance, but did not rear young.

Starling. — This European bird will soon be common and may become a pest. It requires an entrance hole about $1\frac{7}{8}$ inches in diameter, and cannot enter boxes properly made for bluebirds or smaller birds. It will use any tenement suitable for martins, flickers, crested flycatchers or sparrow hawks, such as are described and figured hereafter.

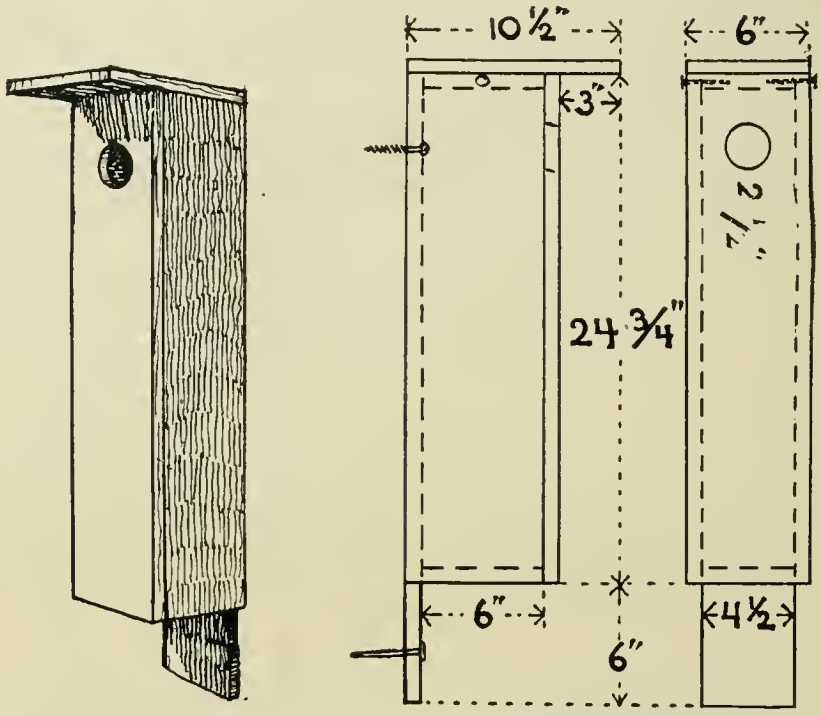


Fig. 16. — Flicker box and details of construction.

Crested Flycatcher. — Measurement of box actually occupied, interior diameter, 6 by 6 by 8 inches. Long axis horizontal. Entrance, 2 inches in diameter. (See Plate IV.) Mr. Henry W. Stillings of Berea, Kentucky, gives the following dimensions of two boxes in which this bird has nested there: No. 1, $8\frac{1}{2}$ inches long, $6\frac{1}{2}$ inches wide, 6 inches high; entrance diameter, 2 inches; entrance, 4 inches above floor. No. 2, 10 inches long, $4\frac{1}{2}$ inches wide, 4 inches high; entrance diameter, $2\frac{1}{2}$ inches; entrance, $1\frac{1}{2}$ inches above floor. This bird has nested in small bird houses, in boxes made of roofing felt, and also in hollow log nesting boxes with the long axis vertical.

Flicker. — Interior dimensions about 22 by about 6 by $4\frac{1}{2}$ inches. (Boxes 12 to 18 inches deep have been used by flickers in some cases.) Long axis vertical. Entrance hole at least $2\frac{1}{2}$ inches in diameter, near top. Several inches of ground cork or

PLATE V.

Fig. 1. — Male flicker on nesting box with young bird looking out. Box made by Mr. E. C. Ware of Wareham, Massachusetts. (Original photograph.)

Fig. 2. — Gray squirrel about to enter flicker's nesting box. Squirrels drive birds from nesting boxes placed on trees. (Original photograph.)

coarse sawdust and dry earth mixed must be placed in the bottom, as woodpeckers make no nest but rely on decaying wood or chips which they strike off the tree to make a bed for their eggs. (See Figs. 16 and 17 and Plate V.)

A Warning. — It is best to have all deep nesting boxes roughened inside. They should be either rough-sawed or scored in some way so that small birds like tree swallows may get out if they once get in. If a box is planed inside and is not large enough in diameter for them to fly out freely they cannot climb out. This is why many have been found dead in such boxes, and why bluebirds cannot escape from water conductors when they get inside and are sometimes found drowned in cisterns.

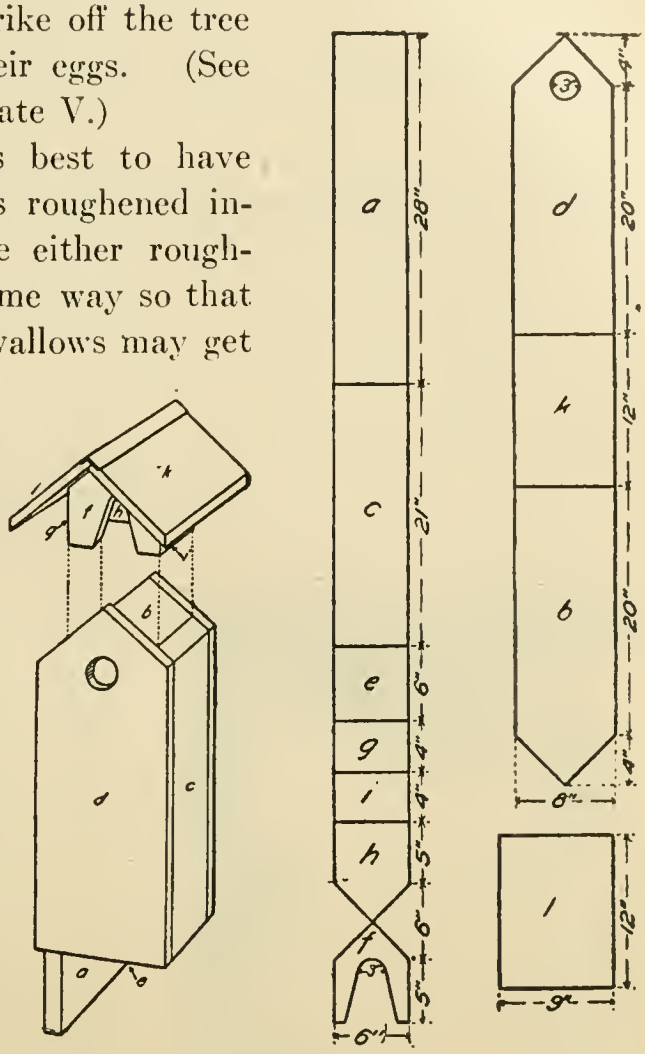


Fig. 17. — Flicker box and details. (After Biological Survey.)

Sparrow Hawk. — Flicker boxes have been used occasionally by sparrow hawks, but a more roomy box, at least 8 inches in diameter, would be better.

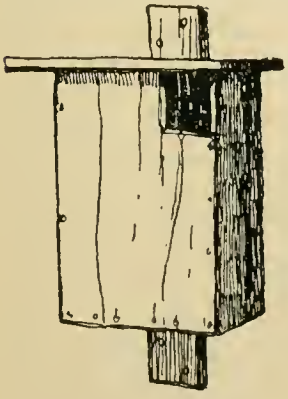


Fig. 18. — Owl box.

Screech Owl. — Inside dimensions of box actually occupied on my place in which young were raised, 7 by 11 by 15 inches. Long axis vertical. Size of entrance hole, 3 inches wide by 4 inches high (Fig. 18).

Wood Duck. — Inside measurements, about 10 by 10 by 24 inches. Entrance, 4 inches in diameter and 18 inches from the bottom. Long axis vertical.

Supporting Shelves and Other Conveniences for Nesting Birds.

Some birds which will not enter bird houses or ordinary nesting boxes may take advantage of other simple facilities for nesting.

Robin. — The robin uses mud as a framework for its nest, and as this makes the nest heavy it requires a good foundation and a roof over it to render it weatherproof. Robins' nests often are dislodged or blown down in storms, and sometimes the birds, warned perhaps by experience, learn to place their nests on some projection under the eaves of a house porch or summer house; on the end of a projecting log under the eaves of a log house; on a beam under the roof of a shed or railway station; under a bridge; under the overhanging sod on the edge of a bank; in a hollow trunk; in a barn cellar; or even in a bird house. Mrs. Mabel Osgood Wright experimented years ago with shallow wooden trays about 6 inches square, bracketing each one to a post, grape arbor or building, always with a branch, eaves, arbor or other screen or protection overhead. The robins did not use them the first year. The second year two were used, and another year five more. These trays should be made so that they will not hold water. Mr. Clayton E. Stone of Lunenburg, Massachusetts, whose boxes for robins are used by the birds, constructs a roofed receptacle of thin box boards, with four corner posts of two pieces each, to support the roof. Dimensions, 7 inches wide, 9 long and $7\frac{1}{2}$ high, with a flat roof overhanging an inch or more all round. In my experience a steep slant to the roof has been most satisfactory, as otherwise the birds sometimes nest on top of the box. A small grape basket hung or nailed up under projecting eaves or a shed roof may be used by robins, swallows or phœbes, particularly if a little hay is placed in it. A pair of Carolina wrens at Fair-

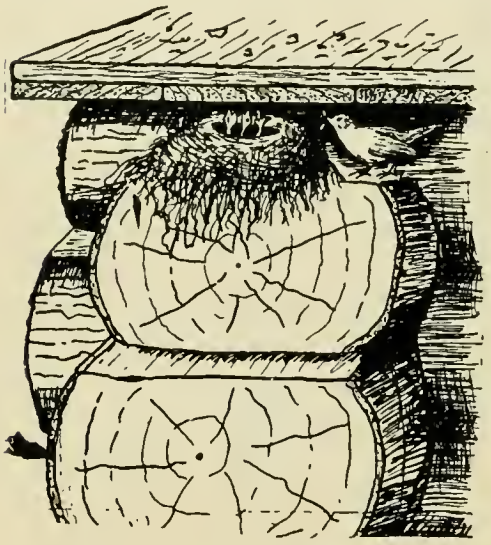


Fig. 19. — Robins' nest on log cabin.

PLATE VI.

A plan for attracting swallows. Barn swallow on nest on projecting end of a board in barn three feet above the back of a stalled cow. The bird chose the situation because of the resting place offered for the nest. (Original photograph taken by reflected light.)

haven nested in such a basket partly filled with dynamite hung under the ridgepole of a barn.

Phœbe. — Any little open box or shelf, put up under the eaves of a building or under the roof of any open shed or porch, may be used by phœbes (Fig. 20). This makes a safe support for their nests which often is appreciated by the birds. Phœbes rarely nest far from water.

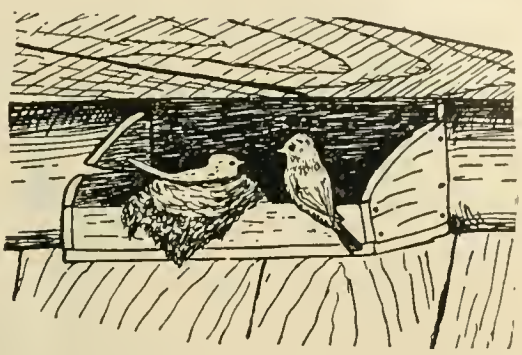


Fig. 20. — Phœbes' nest in box.

Barn Swallow. — Boxes or shelves similar to those used by phœbes may be placed in barns for the barn swallows, but a little block nailed on a rafter is all they need, or a lath nailed across two rafters so that the ends project. (See Plate VI.) Even two nails driven into a beam or rafter about 2 inches apart, the heads projecting about 2 inches, may be utilized, and will furnish support enough to keep the nests from falling.

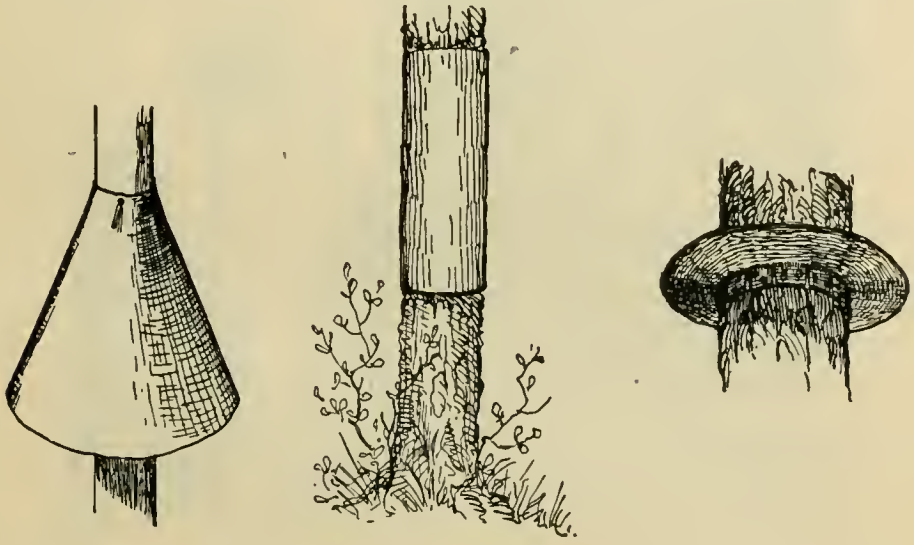


Fig. 21. — Metallic devices to keep cats, squirrels, etc., from climbing to bird houses. That at the left has given best results so far.

When rafters were made of knotty logs or mere poles with the bark removed no such supports were needed, but sawed timbers do not present safe points of attachment for mud-built nests. There should be an opening in every barn for swallows to enter.

Cliff or Eaves Swallows. — These require wide eaves, and on

painted buildings a strip of board or small timber nailed a foot below the junction of the side and roof of the building. Mud does not stick well to paint, hence the need of a supporting ledge.

A Dorothy Perkins rose bush. Grown on a bird-house pole for protection against cats. (After Our Dumb Animals.)

Put Nesting Boxes on Poles.

Experience with nesting boxes on trees, particularly in woods, has proved that they are occupied mainly by squirrels and mice or remain unused. These animals, as well as cats and

PLATE VII.

Fig. 1. — A colony. Three nesting boxes on one tree, all occupied by birds, on the reservation of the Massachusetts Commission on Fisheries and Game at Marthas Vineyard. (Original photograph.)

Fig. 2. — A row of nesting boxes on a pasture fence on the farm of Mr. William P. Wharton, Groton, Massachusetts. This plan is successful. A large proportion of these boxes on all the fences were occupied. (Original photograph.)

sometimes rats, drive the birds out and sometimes destroy their eggs and young. (See Plate V.) Nests on poles are not so often visited by the foregoing enemies of birds, and such nests may

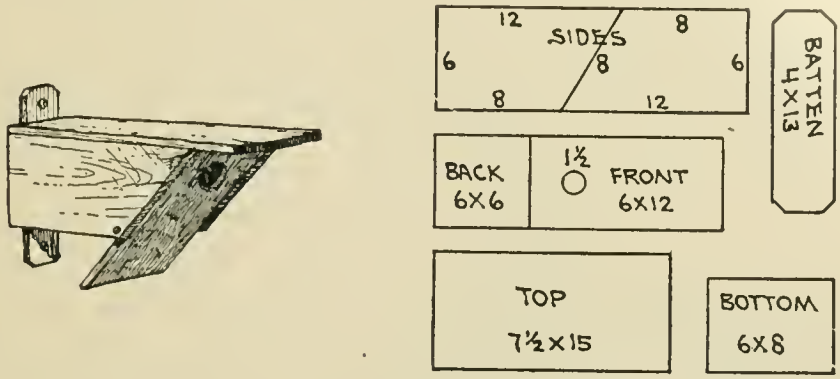


Fig. 22. — Swallow box, supposed to be cat proof, and details of construction.

be protected against them by any one of the devices shown (Fig. 21), or the pole may be ringed about with three rows of large fishhooks nailed or stapled on 2 or 3 feet below the box, points down. Nests on isolated trees may be safeguarded, but in the woods protection is hopeless, and hole-nesting birds, with the exception of chickadees, will rarely nest there. Nesting boxes hung by wires from outer branches of trees on the edge of the woods have given good results in some cases. Cats cannot reach these and squirrels seem not to trouble them often. (See Fig. 23.) Boxes placed on poles set up in a pond or on a small island bring good results.

Fig. 23. — To puzzle cats.

Fig. 24.

Poles set on posts need not be over 6 or 8 feet in length, except for martins, and may be slim, made from young pines, cedars or other saplings. They may be screwed to fence posts with lag screws (large screws with square heads; see Fig. 24 and Plate VII, Fig. 2) so that they may be taken down in the fall and stored away until spring. (The barbed wire fence is best for this purpose as it is not used as a highway by squirrels and cats.) Where there are no fences, posts may be set in the ground and the poles fastened to them. Boxes put up on the walls or ridgepoles of build-

ings often attract birds if the trees are not near enough to allow squirrels to reach them, and if cats cannot get at them. (See Plate VIII.)

How to attract Birds to Nest Boxes.

If nesting boxes are set up in accordance with the foregoing directions, English sparrows disposed of, and nests safeguarded against cats and squirrels, some of the boxes are sure to be occupied by birds, provided there is a sufficient diversity of vegetation in the neighborhood to furnish them with a variety of insect food and wild fruit, and unless they are too much disturbed by the noisy activity of their human, feline or canine neighbors. We cannot expect many birds to be attracted to a city yard where there is neither grass, trees, water nor shrubbery. They always appreciate a near supply of water. If nesting material such as hay, straw, twine, cotton, hair, string, etc., be hung on a fence or placed on a bushy branch near the nesting box, that alone may decide some bird to nest there. If twine is put out it should be cut in short pieces not over a foot in length, else birds may be ensnared by it. Wherever a pair of tree swallows nest, many other boxes, similar to the one chosen by them, should be put up on poles, for they are sociable birds and one pair will attract others.

Experiments sometimes have demonstrated that certain individual birds are grateful for nesting material placed in the box. A pair of chickadees made their nest by digging a hollow in cotton batting that I had placed in the bottom of the box for their use. It is well always to keep a few nesting boxes out all winter with some cotton or other nesting material in the bottom of each, to furnish winter lodging for chickadees, nuthatches and woodpeckers, as these birds like to sleep in such snug quarters. Chickadees and nuthatches may be attracted to nesting boxes by first destroying all the decayed trees and stumps near by, and then feeding the birds all winter on bits of suet, meat, fat or sunflower seeds placed near the boxes. If this supply is kept up during the spring, and if English sparrows are controlled, some of the birds are likely to nest in the boxes and their young seek similar domiciles until a little colony becomes established. Nuthatches may be attracted to nesting boxes in the same way.

PLATE VIII.

An example of a bird colony on a building. Nesting boxes on one of the farm buildings of Mr. Geo. E. Hoxsie of Canonchet, Rhode Island. Every building on his place has nesting boxes. In 1912 forty-three nesting boxes were taken by tree swallows and bluebirds. There were thirty-two nests of eaves swallows and eighteen of barn swallows.

Wrens are rather local in Massachusetts, but when once a colony is started they are almost perfectly protected in nesting boxes and are likely to increase. There should be at least three boxes to each pair of wrens, as they are so industrious that a pair often will build two additional nests beside the one in use, and such building activity may keep them out of mischief. Otherwise they may attack the eggs of other birds.

Many writers express the belief that it is a mistake to put up nesting boxes too near together, as jealousy and fighting will ensue and none of them will be occupied. I have held this view and published it, but have discarded it since I have seen five pairs of bluebirds nesting in the trees around one farm house; three pairs of tree swallows nesting in boxes on one small tree; several pairs of bluebirds in boxes on one barn, and a pair of bluebirds and one of tree swallows on the same pole. (See Plate VII, Fig. 1, and Plate VIII.)

Other things being equal, the more boxes the more birds. But the house wren may be an exception to this rule, as it sometimes is exceedingly quarrelsome. My later experience seems to show that a plethora of boxes makes less trouble than is the case where few are available. In 1915 I had 25 boxes mounted on poles in a field of about two acres, and 24 were occupied by native birds. Ordinarily, boxes set up 100 to 200 feet apart are more likely to be occupied the first year than those situated closer. Later, if these are successful, the number may be increased.

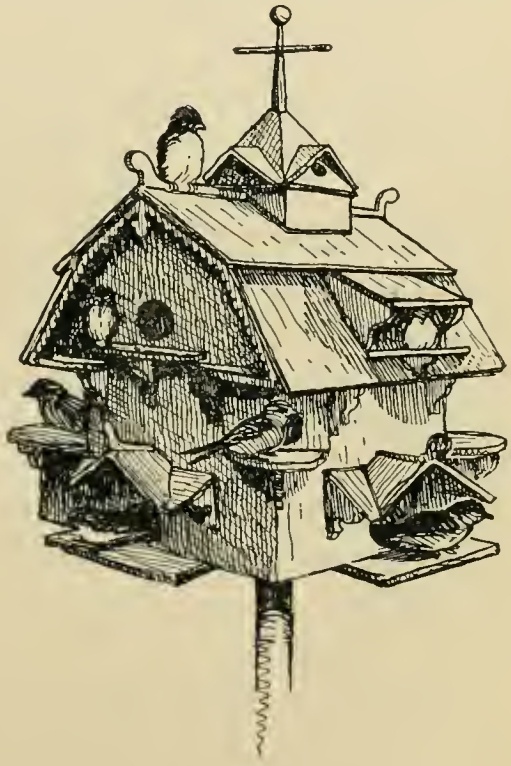


Fig. 25. — Martin house, after Trafton. (Courtesy Houghton Mifflin.)

Martin Houses.

The purple martin is the only bird that needs a bird house. It is a waste of lumber to build houses with many rooms for any other bird, as a single pair of bluebirds, swallows or wrens often will hold a large,

expensive house against all comers except the English sparrow or the starling. The martin is a large, handsome swallow with pleasant, cheerful notes, and is very destructive to insect pests. Martins formerly were abundant locally in Massachusetts, but after the introduction of the English sparrow the number of martins and the localities frequented by them diminished rapidly until 1904, when cold June storms nearly exterminated the species in Massachusetts.

Fig. 26. — Martin house.

Since then their numbers have increased very slowly, as few people now put up martin houses, and English sparrows or other birds keep the martins from settling in some of those that have been erected. Martins, unlike most native hole-nesting birds, prefer to nest in large colonies. Hence martin houses usually are made with many compartments. The Indians hung many hollowed gourds for the martins on the poles of their wigwams or on some dead tree near by. Some of the southern people still use gourds to attract martins. Often several gourds are hung from a crosspiece on a tall pole (Fig. 27), and these collections of gourds are popular with the martins. Only the larger gourds should be used for them. If a round entrance hole is made it should be about $2\frac{1}{2}$ inches in diameter, as the martin likes to have the entrance large enough to admit the light as he enters.

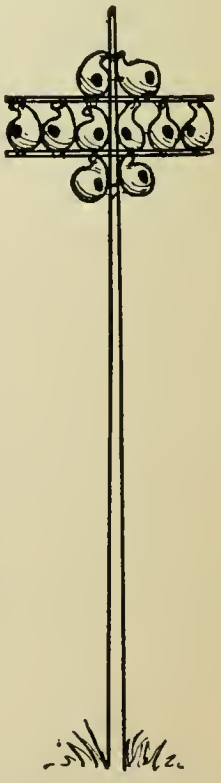


Fig. 27. — Gourds for martins.

Poles for martins should be at least 10 or 12 feet high. Such poles are sufficient if placed in quiet places, not too near trees or dwellings, or where noisy, quick-moving children or dogs are at play; but if there is much noise and disturbance, a pole 20 feet or more in height

may be necessary. No pole is likely to be too high for martins. They seem to prefer a height of 20 or 30 feet. These birds frequently have nested in quiet places among trees and quite near houses, even in nesting boxes on poles on the roofs of wooden buildings or high city blocks, but they will not accept hidden nesting places where they have to fly in among the branches of leafy trees, and they seem to come most readily to a bird house situated in an open yard or on a wide lawn. They seem to prefer low ground to high ground, and always like the neighborhood of water. Therefore an open river valley suits them, but people not having these advantages need not despair, as martins often have nested on high ground, but rarely, I believe, far from water. A drinking and bathing fountain for the birds with running water might help to induce them to settle where other water is absent. A martin house may be made of any strong barrel (Fig. 28), and I have seen such boxes occupied for many years by these birds. The bottom of each entrance hole may be made level with the floor of its compartment, to facilitate cleaning out and to allow any water that may drive in to run out again, but it is well to have a gallery or veranda under the upper openings and overhanging the lower. This and the projecting eaves should shed most of the rain.

Fig. 28. — Martin barrel.

The entrance holes may be made $2\frac{1}{4}$ inches in diameter if square, or $2\frac{1}{2}$ inches if round.

Mr. J. Warren Jacobs of Waynesburg, Pennsylvania, who probably has had more experience in building martin houses than any one else now living, recommends making each apartment 6 inches square and 7 inches high. Any box about this size may be used for the apartments, and all may be backed by a square box running up the center of the barrel into which a square pole will fit. The barrel may be attached to the pole by two angle irons and roofed with zinc. Every martin house should be well painted outside but not inside, with two or three coats of good white or light-colored paint. Dark-colored houses

are very hot in sunny weather. Care is taken not to let the paint run into the entrances, and to paint only up to the edge of each.

Mr. Arthur W. Brockway of Hadlyme, Connecticut, has established a large colony of martins by building small cottages out of grocery boxes. (See Fig. 29.)

Mr. Jacobs asserts that a martin house should have only entrance ventilation, but Mr. Dodson of Chicago makes the attic of his martin house so that it may be entered from either end, but not so that any draft can blow through the nesting apart-

Fig. 29. — Successful soap box martin colony of three houses.

ments, and claims that the martins invariably occupy these upper rooms first. I have noted that when cold storms destroy young martins, those on the sides of the house most exposed to cold winds and rain die first.

Poles may be made of wood or metal. A two-inch galvanized or painted iron pipe will hold a small martin house and will be cat proof and snake proof, but rats or squirrels might climb it. Nevertheless, if the house is large enough they cannot go beyond the floor unless wooden brackets, which should never be used, are provided for them to climb. Sometimes martin houses are mounted on dead trees. Smooth poles are believed to be snake proof. Trees with bark on are not. Cats some-

times quickly climb wooden poles and catch martins by reaching past the lower edge of the house.

Mr. Jacobs uses a hinged pole for mounting his larger bird houses, so that they may be taken down easily and cleaned out and housed during winter.

It would facilitate the handling and cleaning out of martin houses if a door opening to the full width of each compartment could be provided, and then, if bluebirds or tree swallows persisted in occupying it, their nests and young could be removed to single boxes, which should be in readiness in the vicinity.

How to get Martins.

The bird house must be erected in a conspicuous place and the English sparrows and starlings kept out. This may be accomplished by the use of a shotgun,[1] or the entrances may be kept closed until the martins come, when a few may be opened and the martins may be able to beat off the sparrows, but if even one pair of sparrows becomes established in the house, and is allowed to breed, the martins are doomed to eviction sooner or later. They may hold on for a few years, but the sparrows will possess the house in the end. I have never known them to fail. If the martins persist, the sparrows break the eggs or kill the young.

Screech owls and cats must be watched. Cats catch the male martins when, in fighting, they come to the ground, take both parents when they alight on the ground for nesting material, and kill many young ones before they are able to fly well. The owls sometimes get the habit of reaching in at night and pulling out young birds. Martins will drive hawks away.

The English Sparrow.

The European house sparrow is the greatest and most ubiquitous enemy of all native birds that nest in bird houses and nesting boxes. Investigators of the United States Department of Agriculture, after a long and patient study that covered a great part of North America, decided that it was "a curse of

[1] A long-barreled 22 caliber rifle, with extra long shells, smokeless powder and dust shot, is not noisy and ought to be effective at 40 feet.

such virulence that it ought to be systematically attacked and destroyed." [1]

Von Berlepsch rates it as one of the few birds which must be destroyed at his Ornithological Experiment Station.[2]

Although the sparrow, like most birds that live near man, is beneficial at times, most expert testimony is against it. In view of a multitude of requests for information regarding the means for destroying it, a paper on the subject has been issued by the Massachusetts State Department of Agriculture as Circular No. 4.

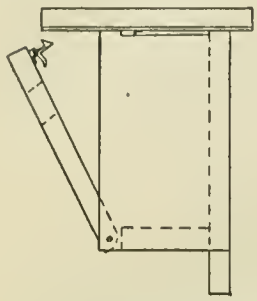


Fig. 30. — Plan for quick opening.

Mr. William F. DeMerrit, of Dover, has shown me a box that will be useful where sparrows are very troublesome. The front is a door hinged by two nails driven in on either side near the bottom. It is provided with a hasp and catch such as are used to fasten the doors of bookcases, and can be opened in a moment and closed as quickly. This is a time-saving device for the use of those who have to inspect many boxes frequently to evict gypsy moths, sparrows or squirrels, but it *cannot be used on flicker boxes,* as the flicker is likely to unlock and open it with a stroke of the bill (Fig. 30).

Remove All Dead Birds.

Sometimes disease, extreme heat or severe storms result in the death of many young or even adult birds in the nests. In such cases *all dead birds should be removed* at once or the living will desert the nesting boxes. At such times these boxes (Fig. 30) will prove a great help, and they are indispensable to any one who has to inspect a large number often.

---

[1] Barrows, W. B.: "The English Sparrow in North America," U. S. Dept. Agr., Div. Ec. Ornith., and Mam. Bull. No. 1. 1889.

[2] Hiesmann, Martin: "How to attract and protect wild birds," translated by Emma S. Buchheim, 1912, p. 92.

The Commonwealth of Massachusetts
STATE DEPARTMENT OF AGRICULTURE
WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 11
May, 1919

ORCHARD, BERRY, AND VEGETABLE FERTILIZERS

Dr. H. J. WHEELER

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

5—'19—1,700.

ORCHARD, BERRY, AND VEGETABLE FERTILIZERS.

BY DR. H. J. WHEELER.

The Massachusetts fruit and vegetable grower who was formerly able to secure an abundant supply of horse manure from the cities and towns is finding to his sorrow that the automobile and truck are so rapidly driving horses from our cities that the supply of manure is not keeping pace with the demand. Furthermore, the city ordinances in some cases require that the liquid manure shall be conducted into the sewers; consequently the manure which the grower is able to purchase often represents merely the "dry bones" from which the real "spirit" has departed.

To illustrate what I mean I will merely call your attention to the average analyses of the solid and liquid portions of horse manure. The solid manure contains about the following: —

	Per Cent.
Nitrogen,	.55
Phosphoric acid,	.30
Potash,	.40

It must be borne in mind, however, that the nitrogen in the solid manure is in a very unavailable form, probably not having more than one-third to one-half the efficiency of the nitrogen in the best organic and mineral ammoniates. The percentage of phosphoric acid is not only low, but the phosphoric acid is also slowly available.

The average composition of liquid manure is about as follows: —

	Per Cent.
Nitrogen,	1.35
Phosphoric acid,	trace
Potash,	1.25

When the liquid manure is absorbed by the solid, so that the mixture represents the normal proportions of the two, the average analysis is about as follows: —

	Per Cent.
Nitrogen,	.70
Phosphoric acid,	.25
Potash,	.55

It will be seen from the foregoing analyses that horse manure, like most other animal manures, is very deficient in phosphoric acid. If manure is to be used in the most economical manner where an abundance of it is available, one should apply enough to supply all of the nitrogen that is required, and supplement it with phosphoric acid, and, if necessary, with additional potash. Unfortunately, the cases are rare where enough manure is available or where its cost is so low that one can follow this procedure; hence the usual practice, and the more rational and economical one ordinarily, is to make smaller applications and then supplement the manure with a fertilizer containing a suitable, moderate percentage of nitrogen, a high percentage of phosphoric acid, and a moderate percentage of potash.

Before proceeding with a discussion of fertilizers in detail, a word should be said about liming. Not long ago, upon looking up some of the experiments with lime in recent years, I found it frequently happened, in cases where lime and fertilizer were used on the same acre of land, that this single acre gave a larger crop than 2 acres, one of which was fertilized and the other limed. In other words, 1 acre, if treated properly, often produces a larger crop than 2 acres when liming is neglected on one and fertilizing on the other. I shall speak further of liming in connection with the discussion of various crops.

It is important in using fertilizers to understand the effect of the individual ingredients on both the soil and the plant. For example, where nitrate of soda is applied to the soil, plants remove the nitric acid faster than they do the soda; hence the residue of soda combines with carbonic acid, forming sodium carbonates. If nitrate of soda is applied year after year in large amounts on a heavy clay soil which has a tendency to bake, the sodium carbonates formed will finally deflocculate the

soil seriously. In other words, they will break up the large aggregations of soil particles of considerable size into such an increased number of smaller ones, that the soil will bake worse than before and become exceedingly difficult to till.

I recall having seen an instance of this kind in connection with experiments conducted by Professor Wohltmann at Poppelsdorf near Bonn, Germany, in 1898. Land which had been fertilized with nitrate of soda year after year finally became so compact and baked so hard that it was almost impossible to work it. If nitrate of soda is used on a sandy or gravelly soil which does not contain much clay or silt, this danger is, of course, not to be feared.

In semiarid regions where alkaline soils prevail the results from using nitrate of soda year after year as the sole source of nitrogen may prove detrimental, not only because the soil is deflocculated, but also because it is rendered too alkaline for the best growth of many plants.

It must be borne in mind in connection with the use of nitrate of soda that it moves freely up and down in the soil. If, therefore, nitrate of soda is used in considerable quantities on open sandy and gravelly loams, such as abound in many parts of New England and particularly in eastern Massachusetts, there is danger that heavy rains may wash considerable of it out through the subsoil. On soils of a heavy clay or silt type, however, the danger of loss by leaching would not be so great.

Sulfate of ammonia has certain distinct advantages over nitrate of soda as a source of nitrogen, for the reason that the ammonia enters into chemical combination with the silicates of the soil in the same manner as lime, magnesia, soda, and potash are known to do. When the ammonia is thus combined, it is not readily subject to loss by leaching. Nevertheless, it gradually becomes available and is taken up by the crops either as ammonia or as nitric acid after its nitrification. In the meantime, it is held in a safe combination in the soil.

In one particular, sulfate of ammonia acts differently from nitrate of soda. For example, if sulfate of ammonia is used year after year on land which is slightly acid or considerably acid at the outset, the acidity gradually increases. This is

obvious when you recall that sulfate of ammonia consists of ammonia combined with the strong mineral acid, — sulfuric acid. When the ammonia has been nitrified or changed to nitric acid in the soil, still another mineral acid is produced; and when this nitric acid has been finally removed and utilized by the plants, most of the sulfuric acid remains behind as a residual product, just as soda is left as a residual product when nitrate of soda is used repeatedly.

In connection with my early experiments in Rhode Island I found that reasonable quantities of sulfate of ammonia proved poisonous in one instance the first year instead of acting as an efficient fertilizer; in another part of the State, it did not become injurious until the second year; and in still another locality, not until the third year. The injury was due to the fact that the soils were fairly to strongly acid at the outset, and their acidity was increased by the sulfate of ammonia to such an extent as to interfere with the proper growth of the plants.

I recall with much interest having visited Professor Storer in 1891 or 1892 for the purpose of consulting his library at the Bussey Institution. My object was to make a careful study of all trials of nitrate of soda and sulfate of ammonia which had been made anywhere in the world up to that time. I told Professor Storer of this experience with sulfate of ammonia at the Rhode Island Experiment Station, adding that I apprehended the difficulty was due to the existing acidity of the soil and that I proposed to apply lime in the effort to correct the condition, in the hope that the sulfate of ammonia would then become an effective fertilizer. In response he warned me that some German investigator had applied lime under somewhat similar conditions and that ammonia was liberated. I believed, however, that if *proper quantities* of lime were used *in the right way*, there was nothing to be feared in this respect. Upon making the experiment the lime was actually found to work wonders, causing the sulfate of ammonia to become a highly effective fertilizer, better even for some crops than nitrate of soda.

When organic ammoniates, such as dried blood, fish, or meat, are used, ammonia is first formed from them in the soil, and

subsequently this ammonia is changed to nitric acid. These substances all have a tendency, therefore, to lessen the basicity of the soil, or, in other words, they tend to make acid soils slightly more acid than before, and alkaline soils less alkaline.

It is possible for one who is thoroughly familiar with the chemistry of these compounds and of these reactions to prepare mixed fertilizers in such a way that they will not change the chemical reaction of the soil, or they may be mixed so that they will make the soil slightly more acid or slightly less acid, as desired. You may ask if this has any practical significance. In reply, I will merely mention the fact that in experiments with cranberries I found that 350 pounds of a properly compounded fertilizer gave $35 to $40 more profit to the acre than the same quantity of a fertilizer which was not suitably compounded.

In regard to organic ammoniates, probably the best and most effective is dried blood, but the quantity produced in the entire country is so small that it is but a "drop in the bucket" by way of furnishing organic nitrogen for the 7,000,000 to 8,000,000 tons of fertilizer used per annum in the United States. Another excellent source of organic nitrogen is fish waste, but the supply of it is relatively small. The chief sources of organic nitrogen are tankage, cottonseed meal, and certain other waste materials.

Did it ever occur to you that the fertilizer industry, by treating waste wool, feathers, hair, and other materials so as to make the nitrogen highly available, is helping to keep down the price of nitrate of soda, sulfate of ammonia, blood, fish, and tankage, and is thus performing a very distinct service to users of fertilizers everywhere in the country? I refer to the possibilities connected with the wet mixing of fertilizer. I could, with your permission, take the hair from your heads, your felt hat from beside you, the wool from the backs of your sheep or waste wool from the industries, as well as many other materials rich in nitrogen, and transform them by chemical treatment into compounds which are completely or almost completely soluble in water. Materials prepared by the wet mixing process have been referred to in a bulletin published by the United States Department of Agriculture as "processed

fertilizers," and in this publication it is stated that "It has been shown that by the process used in the case of this fertilizer the nonavailable nitrogenous materials have been made highly available, not only because the nitrogen compounds can be ammonified quickly in the soil, but also because these compounds are directly utilizable by plants."

It is fortunate, indeed, that such materials, which have a relatively low value as fertilizer if applied in their natural or untreated state, can be transformed into entirely different chemical combinations which have an exceedingly high availability and value for fertilizing purposes. This not only aids in keeping down the price of other organic ammoniates, but it also insures a larger supply of highly available ammoniates.

According to the tests of availability which have been made by various experimenters, the important organic ammoniates stand in about the following order as concerns their availability: —

1. Dried blood.
2. Fish.
2 to 3. Tankage.
3 to 4. Cottonseed meal.
5. Solid horse or cow manure.

Other organic ammoniates, such as roasted or untreated leather, rank so low in availability that they are unfit for use in fertilizers. The agricultural experiment stations are now making tests of the availability of the organic nitrogen in fertilizers in order that the purchaser may be protected against any unscrupulous manufacturer who would be so unwise as to use such materials in their untreated and unavailable state.

What has been said illustrates some of the advantages of the proper compounding, preparation, and mixing of fertilizers. Something should also be added about the importance of having fertilizers in such mechanical condition that they can be stored with the assurance that when the time comes to apply them they will be in good mechanical condition for distribution by machinery or by hand. The fertilizer manufacturer knows that if certain fertilizer ingredients are mixed a short time before their application, they very promptly set or become

hard and lumpy, and therefore unfit for satisfactory or even distribution. One of the important features of manufacturing is to combine and treat these materials in such a way that they will remain in good mechanical condition even if stored for many weeks.

In regard to the fertilization of the orchard, I should emphasize the fact that every orchardist ought to watch the growth and fruiting of his trees as carefully as the breeder of cattle watches the growth and feeding of the individual animals.

Fertilizing Fruit Trees.

Apple Trees. — If apple trees are not properly fertilized they seldom bear every year, fruit spurs and buds do not develop as they should, the trees tend to deteriorate, and the orchard is not likely to yield its maximum profit. On the other hand, it is important to avoid overfertilizing an orchard, particularly with nitrogen. If too much nitrogen is used, it will lead to the abnormal growth of leaves and branches, so that the fruit will be overshaded, poorly colored, and of inferior keeping quality. Where a soil is naturally deficient in phosphoric acid and potash, these fertilizer ingredients are needed in addition to nitrogen.

No man can tell another just how much fertilizer or what grade of fertilizer he should use; but by bearing the preceding suggestions in mind, the intelligent grower should be able to gauge the amount and select the kind of fertilizer suited to the requirements of his whole orchard or individual trees. For very young apple trees, from 1 to 2 pounds of fertilizer to a tree should be sufficient. The quantity should be increased each year, and when the bearing stage is reached 5 to 10 pounds or more may be needed. Large, old trees may require from 25 to 50 pounds.

Peach Trees. — Peach trees in bearing require heavier fertilization per acre than apple trees. As soon as they begin to bear they may need from 10 to 30 pounds or more of fertilizer per tree, depending upon the natural fertility of the soil.

Apricots and Quinces. — Apricots and quinces are probably not grown extensively enough in Massachusetts to require particular mention. They should be properly fertilized, and quinces, at least, require much lime.

Liming Fruit Trees.

It is highly important to consider the effect of lime upon the different kinds of fruits. *Apple trees* will thrive fairly well even on quite acid soils without liming, yet lime may help their growth to a slight extent If, however, some cover crop which is very dependent upon lime is to be grown in the orchard, liming may be advisable. Great caution should be exercised in liming *peach trees.* If lime is used at all, it should be applied in small quantities and at not too frequent intervals. *Plums, cherries,* and *quinces,* on the contrary, all need lime on acid soils. In fact, in many cases financial success with a plum or cherry orchard, and also with quinces, may hinge upon whether the land is properly limed at the outset and at occasional intervals thereafter.

In this connection I am reminded of a visit which I received some years ago at the Rhode Island Agricultural Experiment Station from Mr. J. W. Powell, the well-known horticulturist of New York. He told me about his plum or cherry orchard in which the trees were not growing properly. I thereupon showed him an experiment, which I was then conducting on acid soil, which showed the wonderful effect of lime upon the growth of these trees. Many years elapsed before I met Mr. Powell again, but when I did he wrung my hand in grateful fashion and told me that my suggestion about liming his orchard resulted in its salvation.

Fertilizing Small Fruits.

In fertilizing *strawberries,* great care must be taken to use a sufficient amount of nitrogen to insure strong, vigorous vines. A fair amount of phosphoric acid in available form should be used, and the fertilizer should usually contain a moderately high percentage of potash This is for the reason that the strawberry has a shallow root system and requires a large amount of potash in the formation of the fruit. Many years ago I made a number of analyses of strawberries, and, if my memory serves me correctly, nearly half of the ash of the fruit consisted of potash.

If strawberries are overfertilized with nitrogen, the tendency

is to produce so much foliage that the fruit fails to ripen properly, and the berries are likely to be soft and unfit for shipment. One can use a fertilizer containing a moderate percentage of ammonia and a good percentage of phosphoric acid and potash in the spring as a top or side dressing, just as the plants begin to fruit. After picking has ceased, if it is necessary to promote the growth of vines still further, a fertilizer containing a higher percentage of ammonia may be applied, but no more should be used than is necessary to insure an adequate growth of vine during the remainder of the season. By restricting the amount of ammonia to what is really necessary and by fertilizing liberally with phosphoric acid, and particularly with potash, the best quality of fruit is likely to be produced.

Raspberries. — The red raspberry, like the strawberry, requires extreme care in fertilization. If an excess of nitrogen is used the canes will grow too large, and the fruit will be unduly shaded, poorly formed, and will not stand shipment. The careful grower will use just enough fertilizer early in May, or possibly some of it a little later, to supply sufficient ammonia to insure a reasonable growth of cane for the following year.

It is a good plan to start the plantation in a field which was plowed in the autumn or which was planted to some hoed crop the previous year.

In the case of blackcap raspberries, there is less danger of overfertilizing with nitrogen, although they will not need high fertilization.

Blackberries must also be fertilized with a reasonable amount of ammonia if one would insure sufficient growth, but the amount of nitrogen applied should be so limited as not to cause an excessive growth of cane.

Gooseberries and *currants,* as well as raspberries, should receive a fertilizer containing adequate nitrogen, a fair percentage of phosphoric acid, and a fairly good supply of potash, if the best sort of fruit is sought. Overfertilization of gooseberries and currants with nitrogen should be avoided, yet a reasonable amount of new growth should be promoted each year.

Liming Small Fruits.

Lime should seldom be applied for *strawberries,* as it may injure the plants, and it may, particularly if used in large quantities, encourage the growth of common white clover to such an extent as to cause it to become a pest in the strawberry bed.

The *blackcap raspberry* will thrive well on quite acid soils, even if no lime is used. Nevertheless, there are possibly some soils on which a light application of lime may be helpful.

Blackberries seem to be very indifferent to lime. While they may not be injured by liming, they usually seem to thrive perfectly without it on soils which are exceedingly acid.

Red raspberries seem to respond well to liming on soils where the blackcap raspberry may not respond at all. On very acid soils, therefore, lime should be used for the red raspberry.

Gooseberries and *currants* usually do not thrive well on exceedingly acid soil. Liming is therefore necessary for the best growth of these plants.

Fertilizing Vegetables.

In regard to *potatoes,* good crops have been grown during the past two or three years on old grass land and on old pastures by the use of a fertilizer containing no potash, provided it contained 4 to 5 per cent of ammonia and 8 to 10 per cent of available phosphoric acid. There are, nevertheless, many indications that the potash supply in many places in New England and farther south is running short. When a marked deficiency occurs, the potato leaves tend to curl under at the edges, the tissue between the ribs tends to puff up, and later the upper side of the leaves often takes on a bronzed appearance, due to the death of some of the cells. Wherever such conditions have been observed, it is of the utmost importance that the fertilizer used should contain not less than 4 to 6 per cent of potash.

In Aroostook County, Maine, fertilizers are usually applied for potatoes at the rate of from 1,500 to 2,000 pounds to the acre; but here in Massachusetts, where the production of such

large crops is practically impossible, the application should generally be limited to from 1,200 to 1,700 pounds to the acre. If, however, stable manure is turned under or the land is particularly rich, an application of even as little as 1,000 pounds to the acre in the drill may be sufficient.

I cannot sufficiently emphasize the importance, wherever fertilizer is applied in the drill by hand instead of with the fertilizer planter, of its being thoroughly worked into the soil before the seed is dropped. I once had 2 or 3 acres ruined because the man who applied the fertilizer thought it was sufficient to drag a chain along the furrow after the fertilizer had been strewn in it. This might have answered very well if the potatoes had been planted early in the season while the land was moist, but the planting was done late, when the ground was somewhat dry and warm. When the latter condition prevails, the greatest care must be taken to have the fertilizer mixed most thoroughly with the soil or applied with a potato planter having a fertilizer attachment of such a character that it will not permit the seed and fertilizer to come into direct contact.

Beets, Carrots, Turnips, and *Radishes.* — All of these plants need a fertilizer containing a high percentage of ammonia and quite a high percentage of potash. A liberal percentage of available phosphoric acid is also desirable. Turnips and radishes are especially responsive to phosphoric acid, while beets need less than either turnips or cabbages.

It is interesting to note how some of these crops affect the soil for the crops which follow. In 1917 I grew with the assistance of Mr. Herbert Reiner, at Portsmouth, New Hampshire, beets, carrots, and cabbages on one uniform field and fertilized all of them alike. Sweet corn followed the next year, and it grew far better where the carrots had been grown than where either beets or cabbage had preceded.

Several years ago I had a similar experience at the Rhode Island Station with onions on a series of plots. One plot of land had been devoted to potatoes for two years, another to onions for two years, and still others to buckwheat, mangels, and various other crops for the same length of time. In all there were about fifteen different plots of land, each of which

had been devoted to the growing of a particular crop for two years in succession. All had been fertilized and treated alike in every respect and all had been tested in advance as to the uniformity of the soil by growing the same crops in rows across all of the plots. When onions were grown the third year, the yields ranged from 12 bushels to 412 bushels, according to the crop which had preceded. The poorest onions followed mangels, cabbages, buckwheat, and turnips; they were better following onions than they were following potatoes; but the best crop of all was secured on the area which had been devoted to redtop the previous two years. The other grasses, clovers, corn, and cereals seemed to be better crops to precede the onions than buckwheat or some of the root crops. This is merely suggestive of the fact that we ought to study carefully the effect of crops upon those which follow, so that we may plant in the best order of rotation.

Beets cannot be grown successfully on very acid soils unless lime is used, yet liming the same soil might prove injurious to radishes. Carrots and all types of turnips respond well to liming on acid soils.

Peppers and *eggplants* are both greatly helped by lime if they are grown on very acid soil. The fertilizer used for these plants should be rich in nitrogen, moderately rich in phosphoric acid, and should contain a considerable quantity of potash.

Cabbage, cauliflower, kale, Brussels sprouts, and *similar plants* are all greatly helped by liming on very acid soils. On account of their extensive leaf growth, they require fertilizers not only containing high percentages of nitrogen but also of potash. Some of these plants have a particularly low feeding power for phosphoric acid; hence the fertilizer should contain a high percentage of this ingredient in available form.

Lettuce, spinach, and *upland cress* are among those crops which are most sensitive to acidity; consequently on very acid soils it is of the utmost importance that the land be limed heavily before one attempts to grow them. In this respect they are like onions and beets.

These crops require a fertilizer with a high percentage of nitrogen, a fair percentage of available phosphoric acid, and a moderate to high percentage of potash. In the case of spinach

sufficient nitrogen in suitable forms should be present in the fertilizer to produce plants having thick, dark green leaves. A properly compounded and highly available fertilizer is needed in order to get the best results with all of these crops.

Onions are likely to fail or partially fail if the soil is exceedingly acid, and even on soils which are only moderately to slightly acid applications of lime are likely to be helpful. If the soil is deficient in lime, in nitrogen, in phosphoric acid, or in potash, even though all of the other fertilizer ingredients mentioned are present, onions tend to lag behind in growth. In such cases they have thick necks, and do not ripen as they should. If onions are grown on soils which are properly supplied with lime, and if they receive sufficient nitrogen, an abundant supply of available phosphoric acid, and a liberal supply of potash, the tops of the onions should fall over and ripening should proceed in a normal manner.

Several instances have been brought to my attention within the last two or three years where growers were not able to succeed with onions, and generally it was found to be due to the fact that the land needed lime or that the grower had not used enough available phosphoric acid, although in some cases it was due to a deficiency of either potash or nitrogen.

Cucumbers, Cantaloupes, Watermelons, and Squashes. — All of these crops, except watermelons, respond in a high degree to liming on very acid soils. In fact, cucumbers and cantaloupes especially cannot be grown successfully on exceedingly acid soils until they are limed. The watermelon furnishes a marked contrast to these plants, for good crops can be grown on soils which are so acid that beets, spinach, lettuce, onions, and cantaloupes utterly fail. Nevertheless, I have known instances where a small application of lime containing considerable quantities of magnesia seemed to be slightly beneficial, or at least not noticeably injurious. Whether this was due to the fact that watermelons need more magnesia than is required by some other plants, I am not prepared to say. It has been asserted that this is true of some of the flowering Ericaceæ.

Cucumbers, squashes, and melons should all receive heavy fertilization with nitrogen, a fair to liberal amount of phosphoric acid, and a liberal quantity of potash.

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 12

May, 1919

OUTDOOR BIRD STUDY

HINTS FOR BEGINNERS

EDWARD HOWE FORBUSH

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 12

May, 1919

OUTDOOR BIRD STUDY

HINTS FOR BEGINNERS

EDWARD HOWE FORBUSH

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration.

6-19-3,000

CONTENTS.

OUTDOOR BIRD STUDY.

HINTS FOR BEGINNERS.

INTRODUCTION.

The beginning of interest in bird study is gradual in some cases. In others, especially in the young, it is almost instantly awakened by the unexpected sight of some beautiful bird, or even by a book with colored plates.

All beginners have before them in this study a source of unimagined enjoyment, wonder and delight. Bradford Torrey, whose interest in birds came with mature years, once said that when a man began to be ornithologically inclined, it was very much as if all the birds had just been created, or at least as if they had just been let out of the Ark. "Like the Lord's mercies," he said, "they were new every morning and fresh every evening." John Burroughs asserts that if "you take the first step in ornithology you are ticketed for the whole voyage." This is true of enthusiastic and industrious beginners, some of whom may become ornithologists in the fullness of time, but these hints for outdoor bird study were not written for experienced ornithologists, who do not need them, but for that larger class of people who, having taken the first step, find pleasurable recreation in spending a part of their leisure time in the observation and study of living birds in the field. The first step in this study is to learn how, when and where to find birds.[1]

---

[1] Four Nature Leaflets published by the writer when Ornithologist to the Massachusetts State Board of Agriculture, under the general title "Hints for Outdoor Bird Study," form the basis of the present circular. The demand for these leaflets became so great that by the year 1918 seven editions had been issued. Also most of the material contained in these leaflets had been copied in other public prints, and had been utilized notably as an introductory chapter in the second volume of the "Birds of America," published by the University Society of New York. In 1918 the Great and General Court of Massachusetts abolished the Board of Agriculture, and replaced it with a State Department of Agriculture. The Department has discontinued the publication of Nature Leaflets, but as the demand for the "Hints" continues, the entire matter contained in them has been revised, more or less rewritten, and, with some additions, adapted and prepared as a circular under the above title.

HOW TO FIND BIRDS.

River valleys harbor birds.

There are birds everywhere, but not always. In winter there are practically no birds above the timber line on high mountain peaks or near the north pole. Mr. Donald McMillan, the Arctic explorer, tells me that the raven is almost the only bird that commonly winters at Etah, the northernmost Eskimo settlement in Greenland. During periods of migration, and in the depth of winter, there are always times and places in the temperate zone where there are few, if any, birds. In the breeding season birds may be found, even in the desert, but they prefer some localities to others, and are most numerous in those that suit them best.

Where to Look.

The bird student soon finds that some localities are better supplied with bird life than others. Many species, while migrating, follow or visit such coasts or river valleys as lie along or across their natural lines of migration. The seaboard near Boston and northward, and the valley of the Connecticut River, are much frequented by birds migrating through Massachusetts. Cape Cod and the coast region of southeastern Massachusetts are not visited in spring and summer by so

many land birds. Some water birds, however, are found on or near Cape Cod that are not often seen elsewhere in the State. City dwellers may find many birds in city parks during migrations. Apparently there is something about the lights of a large city, especially on misty nights, that attracts birds when migrating. If a city park with trees, shrubbery and water be visited early each morning in spring and autumn many species may be noted. Birds there, being protected and seeing people continually, are unsuspicious, and may be readily approached. Mr. Horace W. Wright records 120 species in the Boston Public Garden, and Dr. and Mrs. E. W. Vietor have noted 162 species in Prospect Park, Brooklyn, New York.

Birds seek city parks.

Water birds may be found usually in spring and fall in the ponds of large park systems, such as the Middlesex Fells Reservation or the Lynn woods. Many waterfowl now come to the Back Bay Fens, the Charles River Basin and the ponds in Boston. In such places these birds, being less shy than elsewhere, may be watched and studied.

Birds require food, water, shelter, nesting places and protection from their enemies. In localities furnishing all these essentials birds always may be found in their seasons. Water always attracts birds. Therefore the bird watcher seeks the neighborhood of lakes or streams. A broad river valley, with fresh-water meadows, containing small, marshy ponds, if dotted

with trees and bordered by farming lands, orchards and wooded hills, should be an ideal place for birds.

When migrating they appear to stop by preference where there is an abundance of suitable food with which they may replenish the waste of tissues worn by flight. At such times birds that have found food attract by their calls others flying by or overhead; these also are heard or seen by others still, and so they come from far and near. To find a good place for migrating warblers in fall and spring, look for plant lice on the birches in some sheltered locality, — an old neglected pasture overgrown by young birches is an excellent place. Where these insects are numerous it is impossible to pass among the trees without collecting numbers of the little green creatures upon your clothing. Often I have found many migrating warblers in such places, when elsewhere in the woods there were very few to be seen. Sparrows, blackbirds, orioles and other birds of the orchards, swamps and fields are attracted to the woods by these plant lice.

In early spring you may watch the birds when they are feeding on the tiny young tent caterpillars or other leaf-eating larvæ. Both species of cuckoo, the vireos, orioles, chipping sparrows, goldfinches, and several warblers come to the caterpillars' webs either to get food or to procure web to use in the construction of their nests. In May and June an old neglected orchard is a good hunting ground. The apple tree has countless insect enemies, and birds seek them in a neglected orchard where the trees are neither scraped, pruned nor sprayed. To see the birds that come to the orchard, one should find a few trees attacked by cankerworms or other inchworms, then sit down quietly, and watch the birds that come to feed on them. In this way one may see, in an hour or two, nearly all the birds of a locality, for most birds feed on these insects and carry them to their young. In July and August birds may be found in swamps where berries grow. They fly to the wild cherry trees in August and September. Wherever we go we shall find some birds, but if one is in search of a particular species, he may not find it unless he knows where to look.

The common birds that nest here in summer are much influenced by the character of their food in choosing their nesting

sites. Our northern yellow-throat commonly prefers to live near the low, wet border of some running stream, while the chestnut-sided warbler is quite as likely to be found anywhere in sprout land, shrubbery or by the roadside. The pine warbler prefers pitch pines, but the black-throated green warbler is found more among white pines, where the crows and jays breed. The prairie warbler usually is seen on hot or dry, sandy or gravelly lands, among low shrubbery or scattering trees. The redstart seems to like a coppice along a brook, while the oven-bird may be found quite generally distributed among deciduous woods. Scarlet tanagers feed largely on insects infesting white oaks, and, together with rose-breasted grosbeaks, usually may be found in or near large white oaks, but the grosbeaks are not at all confined to the oaks, and usually breed along running streams, in localities frequented by redstarts. Both tanagers and grosbeaks often are common in mixed oak and chestnut woods.

Different species of sparrows also seek diverse localities. The indigo buntings live much among the new sprout growths, where woods recently have been cut off, or in bushy hillside pastures. In the fall they go often to cornfields and gardens. The towhees, or chewinks, usually inhabit, with the thrashers, a slightly larger growth. Grasshopper sparrows, vesper sparrows and field sparrows are largely birds of the open upland fields and pastures, while Henslow's sparrow seeks small patches of low, wet grassland, or large meadows. The song sparrow nests along the shores of rivers and ponds, near swamps or springs, or on the banks of brooks or ditches, while the swamp sparrow seems to prefer bushy swamps bordering on rivers or ponds, and is seen often near the haunts of bitterns, herons, and rails, which frequent marshes, meadows, and low grassy shores.

When to Look.

Early mornings and late afternoons are the best times for observation, partly because most birds are then active and vociferous, and partly because there often is little wind movement then. The least motion of a bird is noticed when the branches and leaves are still, but when the wind blows, birds

are more likely to be overlooked; also they are wilder on windy days, when they can spread their wings and be borne away with little effort. Cool days, with strong northwest winds, are unfavorable for bird study. Warm, still days are best. Small land birds usually seek shelter during heavy rains, but are active during light, warm showers.

The Spring Migration.

Beginners in bird study usually choose the spring as the best time for making the acquaintance of the birds; but it is well to begin early in the year, when birds are few, and learn to recognize each species as it comes. Gulls, wild ducks, and geese begin to go up the rivers in March as soon as the ice breaks up, and mergansers seek open places on the lakes. In March and early April we may find birds on warm days or in sheltered places.

A partly wooded river valley will attract birds in April, when the nights and many of the days are cold. Insects fly on warm days very early in April, in the sunny reaches of such a river. In such spots the rusty blackbird appears. Pine warblers, yellow palm warblers, and ruby-crowned kinglets may be found near the water catching flying insects after the manner of flycatchers. On such rivers herons and bitterns sometimes may be seen very early. The early sparrows feed in April on the sheltered sides of wooded hills, in bushy lands, or on sunny slopes of adjoining fields or pastures. In cold, windy weather birds always prefer the sheltered spots where there is food. By bearing this in mind you may find flickers, meadowlarks, fox sparrows, grackles, blackbirds, cowbirds, robins, and bluebirds in March.

It is well to remember that the old males usually come first, and the females and young birds later.

May is the favorite month for the student of birds, for then most of the migrating birds pass through New England on their way to their northern breeding grounds. Then, also, most of the resident summer birds appear and begin building. Most birds are then at their best in plumage and song.

From the 3d to the 30th of May it is well to be continually

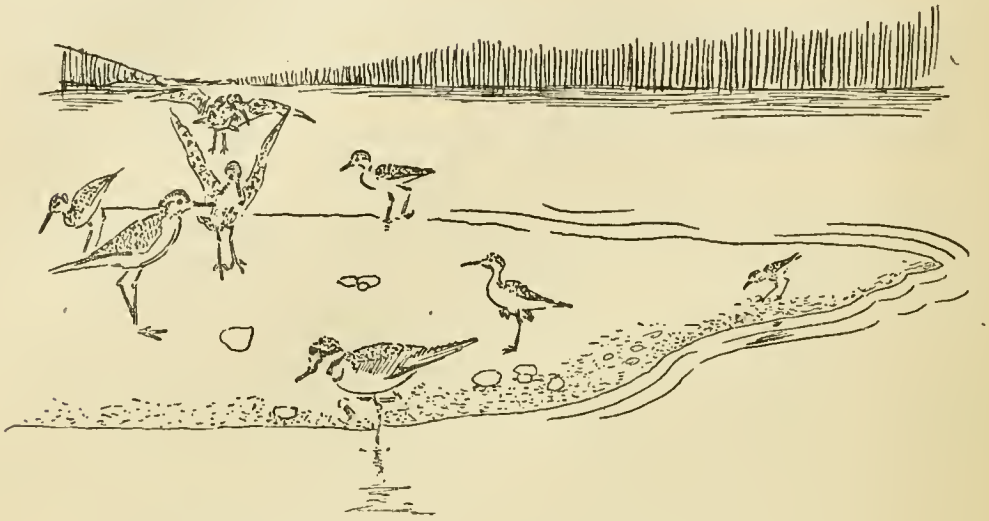
on the watch for new birds. A warm south wind following a long spell of cold weather early in May will sometimes bring a great wave of bird life from the south. At such times the calls and cries of flying birds may be heard all through the first part of the night as they pass at different heights overhead, and a visitor to the woods early next morning may find a host of warblers there. Cold mornings, which occasionally follow such a flight, bring the tired birds to the ground and low shrubbery, in search of benumbed insects hiding there. Such a condition greatly favors the observer. A cold storm coming after a warm wave may have a similar effect by driving the birds from the hills into the valleys. Such storms may also drive sea birds and shore birds to shelter along the beaches, or to ponds and marshes. Ordinarily, more land birds, both species and individuals, may be seen to advantage on still, warm days from the 5th to the 20th of May, or before the leaves become large enough to hide them from view, than at any other season.

May is the best time to find small land birds not often seen by beginners. When warblers are in tall trees they may be seen to the best advantage while the leaves are still small, by climbing a steep, wooded hillside where one can see them on a level with the eye, or below it. The yellow-bellied flycatcher may be found during the latter part of the month in quiet swampy woods. The alder flycatcher may be seen almost anywhere in migration, but usually it flits about alder runs, ponds, and swampy shores. Sometimes the song of the Lincoln's sparrow may be heard along bush-bordered walls or on bushy river shores. Often it is difficult to see this bird unless its song is followed for a time, as its tendency is to keep well within the cover.

The Cape May warbler and the Tennessee warbler are now to be looked for in shrubbery in moist places, or along woodsy river-bottom lands. Sometimes they come into the orchard or the village street. The olive-sided flycatcher is seen in swampy woods about some pond or stream, or in a near-by hill pasture or orchard, while the crested flycatcher flits and loudly calls in old neglected orchards near the woods.

The great spring migration of the shore birds along our coast comes in the last half of May and in early June. Black-

bellied plovers sometimes are abundant about May 30 in suitable localities on Cape Cod. Where the water of a pond is drawn off late in May, sandpipers and plovers of several species are likely to gather.



Migrating shore birds seek ponds where the water is low.

The Nesting Time.

The species of birds to be found in the nesting season at a given place depend largely on the temperature of the locality. "The southward distribution," says Dr. C. Hart Merriam, "is governed by the mean temperature of a brief period during the hottest part of the year." The temperature at this time depends largely on four factors, — the latitude, the altitude, the amount of moisture, and the character of the forests. Latitude and altitude have the same effect. Other conditions being equal, the mean temperature lowers as we go higher up or farther north. Dr. Merriam has been able, after long study and as the result of many exploring expeditions, to divide North America into boreal, austral, and tropical "regions." Massachusetts, largely because of its variations in altitude, has animals and plants of both boreal and austral regions. Dr. Merriam has divided these regions into life zones, — the boreal into the Arctic, Hudsonian and Canadian zones, and the austral into the transition, upper austral and lower austral zones. The zones of the austral region are again divided. The eastern subdivision of the transition zone is called the Alleghanian faunal area, and the eastern division of the upper

austral zone, the Carolinian faunal area.[1] These terms are now generally employed in discussing the distribution of birds. Each region, zone and area has animals and plants which are peculiar to it, or which thrive best within its limits. Certain Carolinian, Alleghanian and Canadian birds breed in Massachusetts, while there is a slight trace of the Hudsonian fauna on Mount Greylock, the highest land in the State. If one wished to find straggling Carolinian birds in Massachusetts in the breeding season, he would naturally seek for them near sea level in the southeastern parts along the coast, or in the valley of the Connecticut River. Here he might find casually the fish crow, the yellow-breasted chat or the Carolina wren. If he were looking for Canadian birds he would go to the higher lands of the northern and western part of the State, where he might find the olive-sided flycatcher, yellow-bellied sapsucker, crossbill, white-throated sparrow, slate-colored junco, pine siskin, blue-headed vireo and several Canadian warblers. In southern Connecticut he might expect to find the sweet gum and the tulip tree, the Louisiana water-thrush and the hooded warbler, but on the hills of northern Berkshire County, Massachusetts, where in both higher latitude and altitude, he would find spruce woods, he might look with confidence for nests of the myrtle warbler and the magnolia warbler.

While the boundaries of the regions, zones and areas are, in general, well marked, the altitude and vegetation of Massachusetts lands are so varied that it might be possible to find Carolinian, Alleghanian and Canadian birds breeding within a short distance of one another. Occasionally, also, we may find the usual conditions reversed. A moist forest lowers the summer temperature. A swamp, with a dense growth of coniferous trees, may be so cool in summer that Canadian birds will breed there, while on near-by hills that have been denuded of their native, coniferous forests and turned into farms, with deciduous woodlots, Alleghanian birds will be found nesting. A deep, cool, wooded, watered ravine in a farming country may serve as a breeding place for Canadian forms which do not nest in the surrounding uplands. Again, in the coastal region,

[1] See the Geographic Distribution of Life in North America. Smithsonian Inst. Report, 1891, pp. 365–415; see also United States Department Agriculture Biological Survey Bulletin No. 10, 1898, pp. 18–31.

the blue-headed vireo, for example, may summer in a lowland grove of tall dense white pines, in the moist interior of which the summer temperature is comparatively low, while in adjacent, open, warm, dry, upland pitch pine woods, with an undergrowth of shrub oaks, the prairie warbler may breed. Some species seem to overflow from their normal breeding grounds. The olive-sided flycatcher and the hermit thrush summer on Cape Cod, and the slate-colored junco has been known to breed in eastern Massachusetts. I have recently seen an occupied nest of the myrtle warbler in the lower lands of southern Worcester County near the Connecticut line.

Changes caused by woodcutting and farming bring about changes in the bird life of a region. The draining of a great swamp may drive out species that previously bred there, and their places may then be taken by others. The draining of a marsh or the cutting of a large tract of timber may have a similar effect. The cutting away of the spruce forest may drive out some Canadian warblers, and at the same time may bring in white-throated sparrows and towhees, which breed in the "slash" and sprout growth. The foregoing considerations may indicate that while a study of the faunal areas and breeding zones is useful to determine where certain species may be nesting, nevertheless breeding birds may be sought and sometimes found quite outside of the areas where one would expect to find them. Therefore every locality should be searched during the nesting season.

July is one of the most interesting months in the bird calendar, for then there are many young birds about, and some of the birds which have reared their young begin to slip away toward the south, and shore birds begin to come from the north.

The Autumnal Migration.

In August many land birds are inactive, shy, and retiring because of their moult. Many others are then leaving for the south, and many which breed to the northward have not yet reached us, but shore birds and a few ducks are then migrating southward, and some shore birds are visiting the shoal spots of lakes and rivers, where the water is low. These birds may be studied to advantage in August and early September.

In August, September, and through October warblers, thrushes, sparrows, and other small land birds arrive from the north. They are followed by birds of prey. Water birds also are continually passing, so that from August until the ponds and rivers freeze, the vast and changing concourse moves on. Look for land birds in the fall, on the fair, warm days, or "weather-breeders," just before storms. In clear nights they may be heard passing overhead. They are then fleeing from the "wrath to come." Easterly storms now bring wading and swimming birds.

Thrushes may be found in sheltered swamps and in woods where late maturing berries grow. Birch plant lice sometimes furnish food for warblers, blackbirds and sparrows in autumn until heavy frosts come.

Sparrows now depend mainly on weed seeds, and may be found in sheltered, weedy cornfields and gardens, along roadsides, or in bushes on sunny hillsides where they can find shelter from strong winds. Weedy places are also frequented by bobwhites. The ruffed grouse or partridge now seeks wild apple trees, and feeds also upon barberries or wild grapes.

There are associations of birds in spring, autumn and winter that the watcher should examine and study carefully. Red-winged or rusty blackbirds, starlings, cowbirds or even meadowlarks may mix with a flock of grackles or with each other. Flocks of common warblers or sparrows should be looked over carefully, as there may be some rare species among them. Never neglect the notes of the black-capped chickadee in the seasons of migration. Then and also in winter other birds may be with or near the chickadees. All companies of chickadees should be examined in winter to see if there are any brown-capped Acadian or Labrador chickadees with them. Flocks of slate-colored juncos may contain one or more of the rarer western forms. In winter goldfinches, redpolls and siskins sometimes accompany each other in feeding, and even flock together.

WINTER BIRDS.

Birds may be found in sheltered places all through the winter. The snow bunting, however, habitually seeks open, grassy fields, far from all cover. Many birds find winter shelter in pine thickets, or roost in cedar swamps. A farmyard with a dense growth of coniferous trees close at hand, with thickets or bushy roadsides nearby, should be good hunting ground. In winter birds often seek a thicket in some valley or ravine along a stream in preference to high open woods. A long thicket at the foot of a southern slope of a wooded hill next to a meadow makes a good winter refuge. Sheltered, tangled patches of goldenrod and other weeds, old gardens, sheltered low pastures overgrown with bushes, alders and birches, and all places where people feed birds should be examined in winter. One who knows the natural food of winter birds and where to find it has a great advantage. For example, crossbills frequent larch, pitch pine, spruce and other coniferous trees when these trees bear seed. Goldfinches and redpolls feed on the seed of the common birch. Many birds feed largely on berries produced by shrubs, vines, or trees that retain their fruit in winter.

In winter the greatest number of species and individuals may be found near the seashore in Massachusetts, particularly near the southeastern coast, which lies not far from the Gulf Stream and has a milder winter climate and less snow than the rest of the State. The coast region of Bristol, Plymouth and Barnstable counties, Nantucket, Martha's Vineyard and the Eliza-

beth Islands, and the waters about them, deserve much more attention from bird lovers in winter than they have received as yet. Rare sea fowl may be seen along the coast in winter after easterly storms.

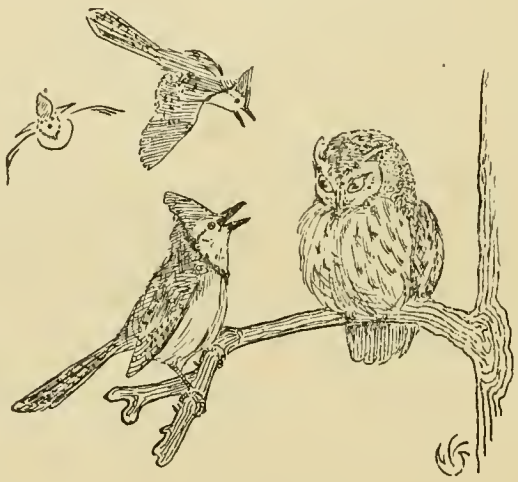
Hawks and Owls.

Great horned owls may be found where hares or rabbits are abundant, or about crow roosts. Crows will often tell you where a great owl is hiding. At such times the owl may be seen, if the observer can approach very skilfully under cover, moving only while the assembled crows caw, and stopping as they cease. Horned owls, snowy owls and barred owls are most often seen in winter. These birds may be observed at times in sparsely wooded country, in open fields, or, rarely, in villages. The snowy owl is most commonly seen along the coast or in open fields or pastures.

Birds of prey return year after year to the same spot to nest. Having once found a nesting place of eagles, hawks or owls you may look for them with confidence year after year on the same cliff or tree, or in the same patch of woodland. The horned owl nests in February, or early March, usually in an old hawk's nest, or in a hollow tree near a swamp; often the nest is not hard to find. The barred owl nests in March and April. Red-shouldered hawks and red-tails nest in April, and most hawks build their nests before the leaves are fully out. Groves of tall white pines are favorite nesting places for hawks. Hawks rarely if ever use dead leaves in nest building, although some use a few green leaves, so the numerous nests seen filled with dead leaves may be attributed to squirrels. Sometimes, however, a hawk or an owl will build upon the foundation of an old squirrel's nest or a crow's nest. Some observing farmers can point out to inquirers a locality where hawks nest. Often the nest is not far from the edge of the woods, and an observer watching from a distant hillside may see the bird fly directly to it. Usually with a good glass one can distinguish a newly occupied nest by its fresh appearance and bits of fluffy, light-colored down clinging somewhere about its edges. Some hawks and owls sit very closely, and can hardly be driven from the nest by pounding on the tree. Others leave at the first

alarm. The long-eared owl commonly is a close sitter. When one has discovered an occupied nest, the chances of watching the occupant from a blind depend on conditions, but while the young are growing the parents are continually going and coming. At such times owls may be seen on the afternoons of cloudy or stormy days.

In severe winter weather screech owls sometimes enter barns, where they kill mice or doves. They nest in April, often in an old, hollow orchard tree. You may sometimes find a screech owl sitting on a limb in daylight or at dusk. If the jays or the smaller birds find it, they will tell you where to look. Jays seem to delight in mobbing a screech owl, and telling everybody all about it.



The busy jays.

The best time to observe the hawks in flight is in September, when they are on their southward migration. A great flight usually goes over near the middle of the month; then one must watch the sky.

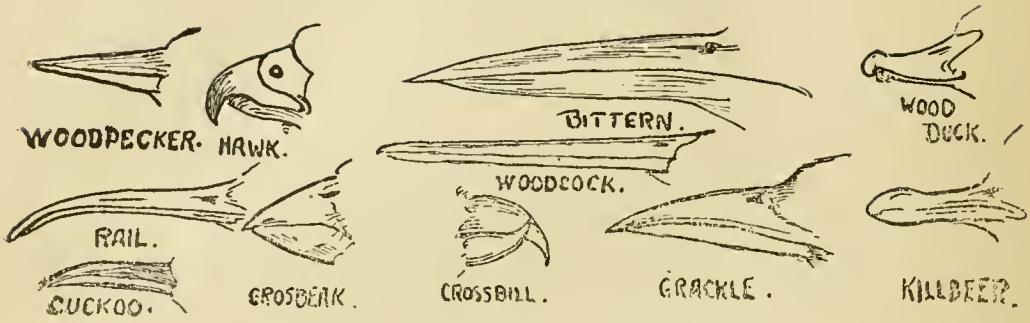
Bird Ventriloquists.

The bird seeker must learn to notice every sound and movement in the woods and fields. He must try to follow every strange note to its source. The expert usually hears a bird before he sees it. Some birds are ventriloquists; when the bird is hidden by the leaves, the song seems to come first from one tree and then from another. For this reason the scarlet

tanager may sometimes be found in summer by going around the place from which the sound of its voice seems to come, or by passing by it, and then returning to it.

Many birds have the power of singing so softly that they seem to be far away when really just at hand. The catbird does this quite commonly, and many other species occasionally sing their full songs in the fall as in the spring, except that they are audible only a few yards away. In mild autumns, or on warm days, some birds sometimes sing almost as well as in the spring. To find birds one must cultivate the senses of sight and hearing to the utmost.

HOW TO KNOW BIRDS.



Note the shape of the bill (see page 26).

Naturally he who begins to study birds, having found one new to him, desires first to know its name and to be able to recognize it at sight. This is the A B C of bird study, — the mere beginning, — but nevertheless important.

Bird Names.

Whoever travels much will find that the names by which certain birds are known to the people change as he passes from place to place. The flicker has more than forty common names in different localities. Some of the shore birds are known by one name on one side of a sound or river, and by another on the opposite shore. Bird names may change as one goes from one township to another. Certain individuals in a town may have one name for a bird, while other townsmen know it by a different name. Uniformity of names is so obviously a practical convenience that ornithologists try to stabilize and simplify the study by giving to each species a fixed cognomen derived from the Latin or Greek, by which it may be known to all ornithologists in any country. Also in the United States ornithologists have adopted a common name for each American bird, by which both ornithologists and the people generally may know it in its native country. The American Ornithologists' Union has established rules of nomenclature for the purpose of fixing the technical names of birds, and these rules have proved so efficacious that they have been largely adopted by zoölogists everywhere. If these tenets

be followed faithfully each species eventually will have a fixed name by which it will be known everywhere. Unfortunately synonyms have multiplied until they have become the despair of the beginner, who prefers, instead, such vernacular names as robin and bluebird, which have become stable and widely used and recognized. The American Ornithologists' Union has turned its attention, also, to stabilizing the common names of birds, and both common and technical names for each species are published in the Check List of the Union, which is the recognized authority for names of North American species; but even now changes not infrequently occur. Fixity in the names of species might have been reached before now, as it is some years since a new species of bird has been observed in North America, but an increased acquaintance with the classification of the birds of the world, also with the early literature of ornithology, and the names in use in other departments of zoölogy, have necessitated many changes in order to conform with the rules. Also the specimens of birds in public and private collections have never been sufficient in number or representative enough geographically to give the systematic ornithologists the material necessary for final and accurate determination. The continual discovery of new subspecies, as material in ornithological collections has increased, has called for new names, and has required continual changes.

Species and subspecies of the same genus differ in appearance from each other mainly in color and size. In the early history of ornithology the species was the unit, but more recently the comparison of many individuals of a species from different parts of its range has led to a recognition of minor differences in size or color, or both. For example, individuals from the northern part of the breeding range of a species may be larger and lighter or darker in color than those in the southern part, while those at mid-range may show size and color intermediate between the two. The two or more geographic forms of a species exhibiting fixed differences are therefore described as races or subspecies, — as Caucasians, Mongolians, and Negroes are characterized as races of man. Ornithologists in naming these races now use the trinomial, or three-name, system. The generic and specific names together denote the species.

The name of the genus comes first, and is capitalized, the name of the species second, and that of the subspecies third. As, for example, the robin: *Planesticus migratorius.* There is but one species of robin in North America. There is a recognized western race of the robin known as *Planesticus migratorius propinquus.* Consequently, we apply to the eastern robin the nomenclatural equivalent: *Planesticus migratorius migratorius.* Then, again, there is a small pale southern robin now known as *Planesticus migratorius achrusterus.*[1] Here is but one robin represented by three subspecies. The differences in size and color are not very great. Why, then, recognize races at all and dignify them by names? To this it may be answered that as we advance in the study of ornithology we are driven to trinomials by the fact that some species are now known to have many geographic races, some one of which may differ far more from some other in size and color than do certain distinct species, and yet there are connecting links between all of these races.

If we take another common and widely distributed bird, the song sparrow, we find that at least twenty-three races of this species are now recognized, and if we compare the small, pallid, desert song sparrow with the large, dark, Aleutian song sparrow we find that these two races of one species differ in size, shape, and color more widely than do such distinct species as the song sparrow and Lincoln's sparrow. There is even more apparent difference in appearance between these two races than the novice will see between the eastern song sparrow and the fox sparrow, — birds not only of different species, but also assigned to different genera. Nevertheless, the pallid or desert song sparrow and the Aleutian song sparrow are connected by a chain of subspecies.

Genera and species are not immutable. Many of the distinctions of the past represented mainly the gropings of the human intellect in a new field. Now minute differences are more carefully noted. Some of the former genera are now regarded as species, and some of the former species are considered as mere races. There is perhaps no fixed and universally accepted definition of just what constitutes a sub-

[1] A fuller discussion of this subject will be found in the revised edition of the Handbook of Birds of Eastern North America, by Frank M. Chapman, 1914, pp. 5-9.

species, and in the finer points of classification ornithologists do not always agree; also there is a constant evolution going on in nature. Many of the races now recognized may be species in the making. If for any reason the connecting links in the chain of subspecies between the pallid or desert song sparrow and the Aleutian song sparrow had disappeared, these two birds would probably be recognized as well-marked species.

Two races of the same species — the pallid song sparrow and the Aleutian song sparrow.

Years ago the heath hen (now extinct except on the island of Martha's Vineyard, Massachusetts) and the prairie chicken were considered by Audubon as one species, and described as the pinnated grouse. Since that time all connecting links between the eastern bird and the western bird have been extirpated, and now we have two distinct species. On the other hand, the western meadowlark, *Sturnella neglecta* of Audubon, is now considered by some ornithologists to be no more than a race of *Sturnella magna*, of which we may perhaps have to record three principal North American forms:[1] *Sturnella magna magna*,

[1] Other races have been described, but they are mainly birds of the southwest or of Mexico and Central America.

the eastern meadowlark; *Sturnella magna neglecta,* the western race; and *Sturnella magna argutula,* the southern form. This is a possibility, not a prediction. Who can say what systematists may do? Already several additional forms of the meadowlark have been described. By describing and recording each geographic race we may some day throw more light on the evolution of species.

What names, then, must the novice choose, who does not care to collect birds and preserve their skins, but wishes only to name the birds without a gun? He should use the vernacular names given in the last edition of the Check List of North American Birds, published by the American Ornithologists' Union. These names are now utilized by practically all publishers of bird books in the United States, but only the most recent editions are up to date.

The student of birds in the field will do well, at first, if he is able to recognize the species, leaving the subspecific determinations to a later period, when he will have the advantage of longer study and experience.

Field Glasses and Other Helps.

To learn to identify birds readily the student needs keen eyes and ears, an opera glass or field glass, a notebook and pencil, a pocket key or a handbook with colored illustrations,[1] and some training in careful observation. It will be a great advantage if there is a museum accessible, where he can see mounted specimens; or a library where he can find the more pretentious works on ornithology that contain colored plates of birds. A small, light-weight opera glass is all that is necessary for viewing the smaller birds at close range. The expensive prism binoculars, magnifying many times, are excellent for the adept, but the beginner with them will have difficulty in finding the bird at all. The 8-power binoculars are excellent to use in the open, and on rather long-distance work, especially at the seashore, and they have an arrangement for adjusting the eyepieces to all eyes; but where a bird is skipping about among the

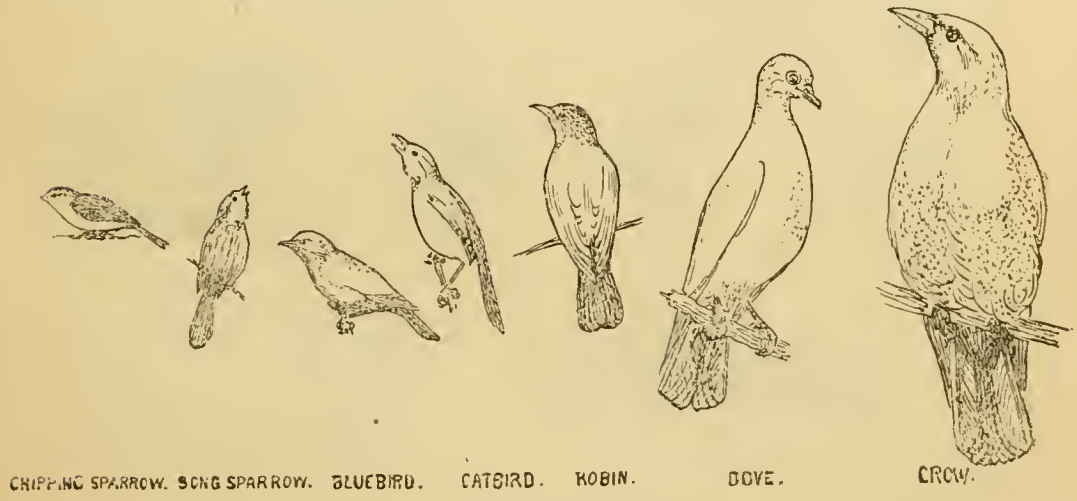
[1] The novice should understand at the outset that most colored illustrations of birds are made by the three-color process, and that the colors not only are inaccurate, but that the colors of the same bird on individual plates may vary considerably; also that in many cases only the spring plumages of the adult birds are shown, and that immature and autumn plumages are sometimes very unlike those of the adults in spring.

branches of trees in the woods, it will often disappear while the novice is trying to follow it with such a glass. A common opera glass of good quality, with a larger field of vision and magnifying about three times, will do very well for ordinary use. Each glass should be tested before purchasing, and the purchaser should, if possible, select a glass with the eyepieces so adjusted that in using it he can see but one field. If he sees "double" the glass is "out of line." For waterfowl or sea birds a marine glass is useful.

To learn the proper use of the opera glass, select some bird in the open that is sitting still, if possible. Have your back to the sun, so that it will shine directly on the bird. Focus the glass on the tree, and then find the bird by noting the position of the branch and sighting the glass as you would a gun.

Points to be Noted.

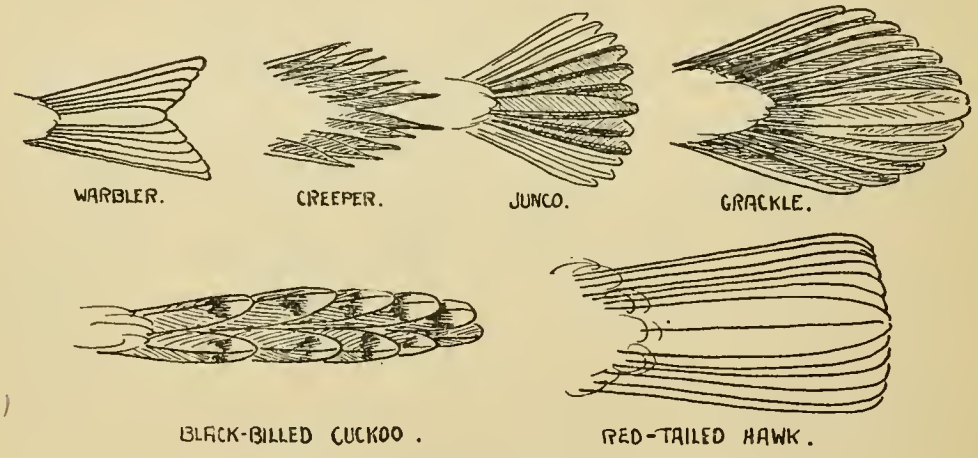
Note the size of the bird. It will be difficult at first to judge this size in inches, but you may compare it with certain com-



Scale of sizes.

mon and well-known birds. You may have a scale of sizes, beginning with the yellow warbler or chipping sparrow, and reading like this: chipping sparrow, song sparrow, bluebird, catbird, robin, dove, crow. Observe these birds well, and note the size of each. Turn to your book and get it in inches. Write it down; commit it to memory; have it always in mind. By making good use of such a scale, you may become expert in judging size by comparison.

Next, the shape of the bird is important. Note whether the bird as a whole is slim or stout. Some allowance may be made regarding how the feathers are carried at the time. All birds can raise or lower the feathers of the body at will. They are likely to appear plumper on cold days than on warm ones. The bill is an important diagnostic feature. Few people who describe birds to me in the hope of having them identified ever mention the bill. If you can see the shape of the beak, you may be able to refer the bird at once to the family to which it belongs. If it is not much larger or smaller than a song sparrow, and has a short conical bill, it is a seed-eater, probably a sparrow. If it is a little smaller than a song sparrow, or about the size of a chippy, and has a rather short but slender bill, nearly straight or a trifle curved, probably it is a warbler, or belongs to some other insect-eating family. Flickers, cuckoos, thrashers, and creepers all have rather slender curved bills. The bills of most woodpeckers are stout and straight; those of most sandpipers are slim and straight, while the bills of plovers resemble those of pigeons and doves.



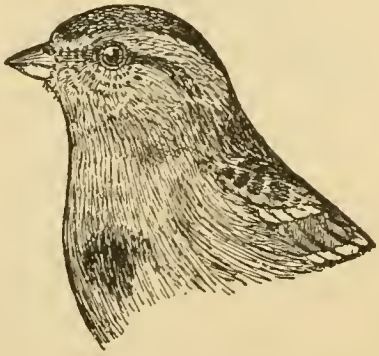
Note the shape of the tail.

The length and shape of the tail are important. Try to see whether the tail is long or short, and whether the end is rounded, square, or forked. If the bird is large, with a hooked beak and long tail, probably it is a hawk. If the beak is long and straight, or nearly so, the tail short and the legs long, it must be a heron, or some other wading bird.

The color of the bird is very important; indeed, it is about

the only feature ordinarily observed. First, if possible, note the color of the upper parts, *i.e.*, the top and sides of head, back and sides of neck, back, wings, and tail; next that of the under parts, — throat, front of neck, breast, and belly. Remember that the breast and belly often will seem darker than they really are, on account of being in shade. Thus a pure white will seem gray. Many birds have some prominent mark or color by which they may be identified in the field. Be careful to note just where each color actually is; then note any conspicuous mark, and exactly where it is placed, for such a mark alone, taken with its situation and the size of the bird, often is enough to establish its identity. The vesper sparrow, for example, is known from all the other common summer

Song sparrow.



Tree sparrow.

sparrows by the white webs of the two outer pairs of tail feathers, which show in flight; while the junco may be known from other winter sparrows by a somewhat similar marking. The song sparrow shows a cluster of spots which form a blotch on its spotted breast just below the throat, while the tree sparrow has a single spot on a plain gray breast, and two whitish wing bars. The flicker and the meadowlark each have a black crescent on the upper part of the breast, but the flicker's breast is dotted, while the meadowlark's is a clear yellow. The color of the bill or feet may sometimes aid in identifying.

In this work the notebook and pencil are indispensable. The effect of noting down details on the spot is to sharpen the powers of observation and strengthen the memory. Then, also, you have something permanent to refresh your recollec-

tion. Note down on the spot, size, shape, color, and markings, also shape and appearance of beak and tail (when you can see them), for future reference. This will help you to identify the bird, and to fix its identity in your memory, or, if you carry a handbook with colored illustrations, look up the bird at once, so as to settle the matter by further examination of the bird, if possible. Remember, however, that no handbook gives color plates of all plumages of all the birds.

The expert can determine many birds at a distance by their characteristic flight. An ornithologist, constantly in the field, can identify many a bird by its flight alone at a distance greater than that at which most people can recognize a friend by some peculiarity of his gait; and the beginner, by making good use of his opportunities, will soon learn to recognize a buzzard hawk such as the red-tail by its wheeling flight, or a flying green heron by the downward bend of its wing tips. All woodpeckers bound forward in flight, as they travel by rising for a few wing beats, and then sliding downward with the wings partly closed. The goldfinch also has an up-and-down flight. The gait of the bird on the ground may determine the species or at least the family. Crows, grackles, blackbirds, ovenbirds, and some others walk, while most birds progress by hopping, although now and then a hopping bird may surprise you by walking a few steps on clear, open ground. The titlark, the yellow palm warbler and the water thrushes all wag the tail up and down while moving about, — something not habitual with most other birds.

Bird Notes as a Means of Identification.

The notes of birds serve as an excellent means of identification, although there are a few birds which can imitate well the notes of others. Among these are the crow, blue jay, catbird, brown thrasher, starling, and the famous mockingbird. The note furnishes a clue to the presence of the bird, and assists the searcher in his quest, but if he relies on the note alone he may be mistaken. No rare bird should ever be identified and recorded by its note alone. I have seen a black-throated green warbler in the act of singing continually the full song of a

warbling vireo, a blue jay singing exactly the song of a Baltimore oriole, another reproducing the whisper-song of the catbird in October, and a catbird giving the note of the crested flycatcher. The blue jay often utters a cry like that of the red-shouldered hawk.

I have heard from the marshy border of a river notes exactly like some produced by the flicker and the bobwhite, which I was forced to attribute to a sora rail. Mr. Henry Oldys of Silver Spring, Maryland, informs me that he has heard the note of the towhee given by a Bewick's wren and a song sparrow; those of the cardinal grosbeak, wood thrush and red-winged blackbird by the catbird; those of the phœbe by a

Two imitators — the starling and the catbird.

shrike and a chickadee (not the so-called phœbe song of the chickadee, but a much closer imitation that so deceived him that he recorded the phœbe's arrival prematurely for four successive years). He asserts that he has seen the black and white warbler utter the note of the chipping sparrow, the red-eyed vireo imitate the wood thrush, and the yellow-breasted chat mimic the bobwhite. The mockingbird, which imitates many species, is rare in Massachusetts, but the European starling is fast becoming abundant. It mocks the meadowlark and other birds, and there are starlings with powers of mimicry second only to those of the mockingbird.

Mr. Adrian P. Whiting of Plymouth records that on March 2, 1919, he watched some starlings, one or more of which imitated the English sparrow, red-winged blackbird, blue jay, barn swallow, red-shouldered hawk, bobwhite, purple martin, wood

pewee, wood thrush, goldfinch and grackle; also they gave many queer sounds resembling those produced by parrots. Mr. Bromley of Southbridge, Massachusetts, reports that he has heard the starling successfully imitate several of these notes, and also that of the phœbe, and that he saw one starling apparently attempting the notes of the whippoorwill.

As a novice will see colors in the wrong places, or fail to see colors in the right places, so he will hear birds wrongly, or fail to hear them at all.

Day by day people canoeing on the river pass my window, while the note of the bittern booms over the river meadows. It may be heard a mile, yet they never hear it; or rather, they are not conscious of hearing it, or they mistake it for the sound of a wooden pump. As evening falls, night herons call and croak along the river, but these people do not hear the raucous cries, or rather, they do not notice them, or perhaps they ascribe them to dogs. The student of birds soon learns to distinguish such sounds as these, but he cannot realize immediately that the song of the grasshopper sparrow is not that of one of the insects of the field, nor does he learn at once to hear the faint chirps of the migrating host of wood warblers which pass over or through the country twice each year nearly unnoticed.

An ornithologist if stricken blind, but endowed with perfect hearing, might still get an approximate idea of the number of birds of most species resident in a locality, for most birds are vociferous at times, and some much of the time.

Many people, however, have great difficulty in recognizing or remembering bird notes. Others are affected with tone deafness, and are unable to differentiate between tones and calls of an entirely different quality. Many persons of middle age who can hear ordinary conversation cannot distinguish the notes of warblers and other small birds at a distance, as all such notes, pitched higher than the upper octaves of the piano, are of such fine quality that they make little impression on the eardrums of those whose hearing is at all impaired.

In studying bird songs the notebook is indispensable. Write down in syllables what the bird seems to say as you hear it at the time. Accent it as the bird accents it, and if you are musical you may even get an approximation of it by note.

These notes may refresh your memory, and help fix the call or song in your mind.

Birds do not really articulate, or if they do, the sounds are mostly vowels:[1] yet we may imagine that they enunciate words. In learning the songs of birds one may take the notes of some common loud singer, like the robin, as a standard, and by comparison determine how those of other species differ from it. This is good training for the ear. Some people cannot see any difference at first between the songs of the robin and the wood thrush, but to the initiated they have nothing in common. In quality of tone beginners usually see little difference between the songs of the Baltimore oriole, the robin, the scarlet tanager, and the rose-breasted grosbeak. Nevertheless, the oriole's lay is almost a pure whistle, the tune varying much with different individuals; the robin's song is a bold warble, a little strident in places; the tanager sings a weaker, finer note, like an undeveloped, hoarse robin; and the grosbeak has a beautiful clear warble, rather loud at times, but perfectly pure and mellow.

Unfortunately for the novice, a bird may have two or more distinct songs. Some commonly have many, while rarely do two individual birds of a species sing precisely the same tune; but this disparity only makes the study of their vocal powers more interesting. Occasionally a very gifted individual will eclipse the performance of all rivals. The caw of the common crow is well known, but its love notes and its conversational abilities when ministering to its young are seldom recognized. In early spring or late winter the crow often gives forth quite musical sounds, and I have heard one closely imitate other birds and animals, though this is probably exceptional. Many singers not ordinarily gifted have beautiful flight songs. It is not generally known that individual meadowlarks are fine singers when in flight.

---

[1] Mr. Francis H. Allen, who kindly consented to read the manuscript of this paper, makes the following comments: "Doubtless consonants sometimes seem to be present in bird notes when a vocal sound is repeated rapidly, but often the effect of a consonant sound is very striking, — r's and l's, and even p's and k's, etc., — but where two consonants appear to be present in a single syllable, I am convinced that they are often uttered almost or quite simultaneously, in a way that is impossible in human speech; that is, a note may have an r and an s in it, and you cannot possibly say which comes first. In syllabifying bird notes we can only approximate them."

Trying out the Plan of Identification.

Now to put our plan of identification to the proof. We are boating some cloudy afternoon along the margin of a river meadow. We enter an opening crowded with lily pads, where a small slough opens into the stream. A bird larger than a crow flies up from among the reeds; its long, nearly straight beak, its short tail, its long legs, hanging down at the start, and its manner of flight, with neck extended at first and then drawn in, proclaims to the world that it is a heron. It ap-

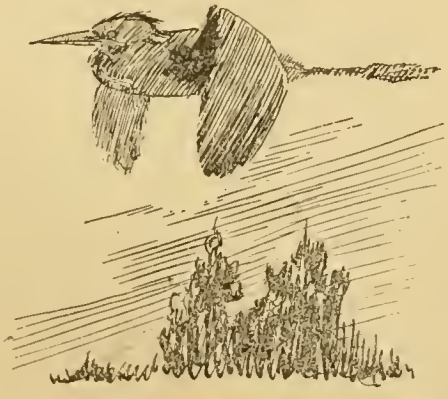
Night heron.

pears to be ash gray above, whitish below, but looks blackish on the crown and back. As it flaps heavily away it sends back a loud *quock*. We have seen enough to learn from our key that the bird is an adult night heron. Soon another flies. It appears like the first in size, but it is rich brown in color above and lighter below, streaked and mottled. Its note is a croak, not nearly so explosive as that of the first bird, and it flies a little slower. Our book tells us at once that we have seen the American bittern, even if we have failed to observe the black streak on the side of the neck. As we drift on down the river, a startling *scowoo* comes from the trees on shore, followed later by a few dry cacklings. Then a smaller heron,

that appears hardly as large as a crow, flies out over the river, with a harsh *squawk* or *quak*, and down along the shore. Its

Bittern.

wing strokes are rather quick, but there seems to be almost a pause between strokes when the wing is held with downward-bending tips. In color the bird seems dark, with a greenish back and bluish-green wings. Its size, flight, note, and color proclaim it an adult green heron. Soon another bird, resembling the night heron somewhat in size and color, is seen flying low over the meadow, coming upstream. As it comes abreast



Green heron.

of our position we can see with the glass that there is no long bill, neither are there any long legs dangling behind, nor is

there any blackish tone on the back, but the bird has a long tail and black wing tips. It moves in silence, and now it hovers over a tussock, dives into it and goes on. The screaming blackbirds chase it across the meadow. This is no heron, but a hawk; its size, larger than a crow, its color, light ashy above and nearly white below, its black wing tips, — all show it to be an adult male marsh hawk. Thus we see how a few well-marked characters may enable us to identify our birds.

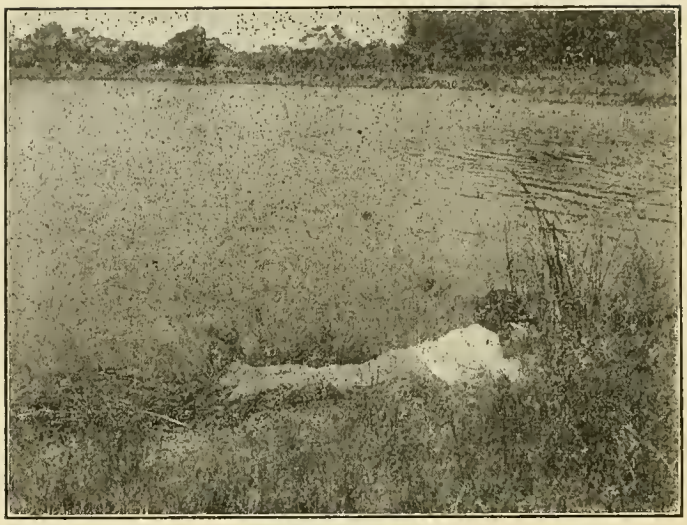
Marsh hawk.

As one advances in the study, the manner in which birds feed, the character of the locality in which they are found, the location and construction of the nests, the size and color of the eggs, — all tend toward fixing the identity of the birds.

It is well, before going to a marsh or lake, the seacoast, or a dense forest, to "read up" on the birds to be found in such localities. A key to the birds, with a system based on the colors and markings, will be serviceable, particularly to those who are not intending to study ornithology scientifically, and have no opportunity to handle and examine specimens. The

work of identification will be difficult at first, — far more difficult than it would be in the study of botany or geology, for the birds will not always stay to be studied. But in time one learns to recognize many species at the first glance, until, almost unconsciously, he comes to a time when most of the birds he sees or hears are old friends. With me the day has long since passed when new birds could be seen or heard almost daily. I have traveled thousands of miles and have endured many hardships to see and hear new birds. But you who are just beginning this study may meet a new bird any spring day merely by walking out into the pleasant fields and green woods. For you the keen delight of search, discovery, and pursuit are close at hand. Surprises await you at every turn. Delay not, then, but turn at once to the woods and fields.

HOW TO APPROACH BIRDS.



Watching the wild fowl.

Even the novice need not be taught how to approach the more common and familiar birds, which seem to court, rather than shun, human companionship; but there are times when it becomes necessary to get close to a rare bird, to examine it carefully or observe its habits, while a near approach to a shy bird may tax the powers of the most skilful observer.

The Approach on Foot.

To be successful in this the beginner must imitate in some respects the behavior of the fox or the lynx, which are able occasionally to get near enough to wild birds to capture some that the human animal finds difficult to get within range of his field glass. How are the wild animals enabled to do this? (1) They are inconspicuously or protectively colored. (2) Their feet are softly padded and their movements noiseless. (3) They go on all fours, creeping close to the ground, and, taking advantage of the slightest cover, keep concealed as much as possible. (4) Their movements are so slow, at need, as to be imperceptible. In all these things we may imitate them.

Bird students often are dressed conspicuously, and shod with hard leather. Their tread, as it jars on the delicate senses of the lower animals, seems to shake the ground. The dead

wood is broken underfoot. They talk, laugh, and even shout with a loud voice. Standing erect, they are exposed to the view of birds for a mile or more around. Some of them wear large headgear, adorned with long feathers, and turn their heads about quickly. They swing their arms, and move about, pointing, gesticulating, and assuming attitudes all of which seem menacing and fearsome to the shyer birds.

Even such students will see birds, for many of our feathered friends have become accustomed to strange sounds and antics. But the expert who sees all the birds has taken lessons from the fox; he hunts alone. When one is in the company of others, nature never completely enthralls him. His attention is more or less distracted by his companions, he fails to see and hear all.

The bird student should attend entirely to the birds, and then they will requite his singleness of purpose. When alone, he has no one to converse with and no interruptions. The human voice warns all creatures from afar of the approach of their arch enemy, man; let it be stilled, and nature is at peace.[1]

There are many women interested in the study of birds who may be too timid to go out alone. In such cases much may be gained at first by employing an experienced teacher; but a party of women having some knowledge of birds can go out together and then separate, remaining within call. They will then be safer in the woods than in the city.

We may muffle the tread by wearing rubbers, or, better, shoes with rubber heels and rubber or fiber soles. Those having merely an outer lift and tap of rubber on heel and toe are best. The rubber will prevent the feet from slipping on rocks and pine-clad hillsides. The light canvas "sneakers" commonly used are not sufficient protection to the feet on rough, stony ground. Leather footgear should not be stiff or squeaky. We may avoid the rustling of dry leaves by choosing for our tramps the early morning, when the dew is on, or the hour succeeding a light shower. Care should be taken not to tread on dry sticks so as to break them, as sharp sounds alarm all wild creatures.

In dressing avoid black, white, and all striking colors and

[1] It should be understood that the more familiar birds are not likely to be much alarmed by common conversation.

contrasts. A dull dead-leaf color, like that of the shooting coats ordinarily sold to sportsmen, is good at any time. In spring and summer green is very good. Certain grays and browns harmonize with natural objects.

The vision of most birds is far superior to our own, or that of mammals; it is nearly, if not absolutely, perfect. Therefore, it is necessary in approaching shy birds, such as waterfowl or hawks, to use as cover, trees, shrubs, or grasses. Often one can advance only on hands and knees, or crawl prone like a serpent.

Frequently I have approached wild fowl by creeping in the paths made by raccoons, hares, opossums and other animals under grasses and low shrubbery. At other times I have been obliged to creep or wriggle through short grass, in mud and water, to reach some desired point of observation. In such cases, when within sight of the birds, a screen of vegetation must be kept always before the face, or the birds will take alarm and be off at once. Birds so wild that they will not allow a man on foot to come within half a mile may be approached noiselessly in this way within twenty or thirty yards, but the labor and discomfort are great.

The approach *a la* serpent.

When nearing shy birds in this manner, keep under cover and do not raise the head. If it becomes necessary to take an observation, the head must be raised but little, and both raised and lowered so slowly that the motion will be imperceptible. Always approach against the wind if possible, for the birds are then less likely to hear you. Do not allow the sun to strike on any metallic or glass object, for the reflection or flash will give the alarm.

Many people will not take such pains in approaching birds. Others cannot, but must either decoy the birds within reach, watch them with long-range glasses from wooded shores, or get

up to them in less difficult and more conventional ways. Such people may see shy birds sometimes at rather close quarters by driving slowly along the country roads. The extra elevation given the observer by the vehicle increases his visual possibilities, and the birds have learned not to be suspicious of an equipage on the road. Birds sometimes may be approached on horseback better than on foot. Gunners sometimes employ grazing cattle as moving shields behind which they near the game unnoticed.

When approaching shy birds on foot in the open, a zigzag, circular or sidelong course may bring you much nearer than will a direct forward movement. It is well to avoid the appearance of stealth, and seem not to notice your bird. Make no quick movements, and do not hurry. Most birds meet violent deaths, and they must be constantly on the watch for their enemies. They are accustomed to flee for their lives from quick-moving creatures. Quick movements with the raised arms should be avoided, and the glass should be raised slowly.

The Use of Canoes or Boats.

Shy water birds and marsh birds sometimes may be approached by the skilful use of a canoe. Let the canoe drift slowly along the marshy margin of a river, and watch the reeds and rushes closely. In this way rails, coots, gallinules, and sand-

The silent canoe.

pipers are seen at close range. I have approached very near to resting flocks of shore birds by sitting or lying motionless in an Indian canoe, and drifting down upon them. The canoe may be used to advantage on a river, not only in watching

bitterns, rails, and other marsh birds, but also in going close to the smaller land birds in trees and bushes on the bank. For this purpose the canoe is much superior to the rowboat. It is noiseless and the paddler faces the bow. Many birds may be seen at close range by working a sailboat up or down a river before a light, fair breeze. A small boat covered with bushes, and sculled or allowed to drift down on birds, sometimes is useful. A fast-sailing boat is one of the best devices for approaching swimming birds on a windy day. Such a boat maneuvered skilfully will be upon the birds before they are aware of its nearness. During a squall I once drove a sloop so near a sheldrake that the bird rose on the next sea as we swept past. There is an advantage in sailing down wind, as the bird must rise toward you against the wind, and may come quite near, giving a good view, first of the breast and then of the back as it turns away. The noisy motor boat is the abomination of the bird student. It has driven most of the waterfowl from our eastern rivers.

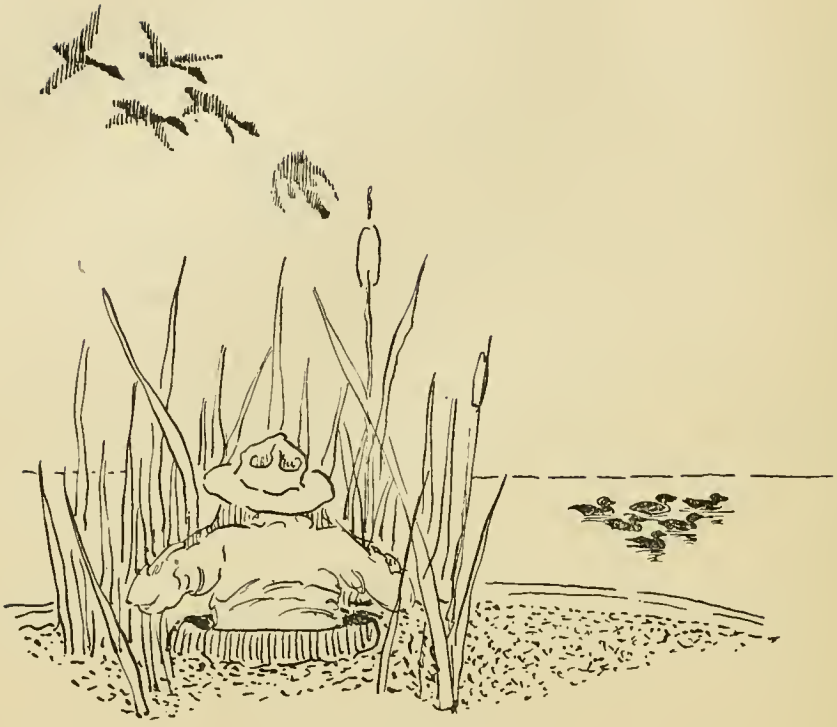
Watching Birds' Nests.

When birds have young in the nest they usually are less shy than at other times, forgetting their regard for their own safety in their solicitude for the welfare of their offspring. Therefore they are then comparatively easy to approach. For this reason, if for no other, the bird student should strive to find the nesting sites. He should hunt for the nests of birds in winter, or very early in spring, while the trees are still leafless. Some birds use the old nest, others build again on the same bush or tree, or near it. A record of the old nests found will tell the searcher where to look for new ones in nesting time. By visiting such situations when birds are nesting one may see the birds carrying building material to their new nests.

A word of caution is necessary here, however. Those who have found and watched birds' nests often complain that something usually happens to the eggs or the young birds. I have learned by sad experience that a close and frequent examination of a bird's nest in the woods only serves to call the attention of the bird's enemies. There are creatures always on the watch for an opportunity to rob birds' nests. The fox sometimes fol-

lows a man-track. Perhaps he has learned that the path of man in the woods may lead to food. Too often the man-trail leads to wounded or dead birds and animals, — a lunch that may reward the fox. Fish heads and other offal are thrown out around a camping place. So Reynard cunningly follows. Those who watch or photograph birds' nests on the ground run the risk of leading both fox and skunk to them. A friend who was photographing birds' nests found that they were being robbed by a fox which was actually seen following the trail. Those who closely examine the nests of birds in trees or shrubbery are likely to be watched unawares by the astute and cautious crow, the thieving jay, the mischievous squirrel, or the bloodthirsty weasel. I have seen both jay and squirrel following a man through the woods, keeping well hidden from his sight. If you approach a nest containing young, the cries of the parent birds may apprise all the wood folk of its location. Therefore, watch the birds with a glass, and do not go to the nest. Those who approach the nests of herons or water birds that breed in colonies drive the old birds away, and thus expose the eggs and young to the attacks of crows, for crows are quick to seize such opportunities. When watching a nest, approach it with caution, and observe it from such a distance that neither young nor old will be much disturbed by your presence. Many interesting habits may be seen in this way if a good glass be used.

HOW TO ATTRACT BIRDS.



Decoying wild fowl.

He, who, unable to go far afield, waits and watches for birds in some secluded spot, or imitates their notes and so calls them to him, may learn more of their ways than will the most active pedestrian.

Luring Birds by Food.

Suet.

The country dweller may entice birds to the homestead by planting fruit-bearing trees, shrubs, vines, and other plants that will supply them with food. . Even the urbanite possibly may attract a few chickadees or nuthatches in winter by putting out suet on trees; but other means are required to bring birds about the student in the field. You may facilitate your winter bird study by scattering millet seed or hayseed in suitable spots along your walks, or by hanging bones and suet in favor-

ably situated trees, that you can visit now and then. In spring and fall small grain will attract thrashers, blackbirds, bob-whites, and crows. Chestnut and corn scattered about in the late fall or early winter will gather all the blue jays in the countryside.

Imitating Birds' Notes.

In summer, if the person be carefully concealed, some of the shyest birds may be brought near by mimicking their notes. Many bird notes may be imitated by the voice. Crows, owls, some herons, and some ducks may be deceived in this manner. The bobwhite, whippoorwill, red-shouldered hawk, Baltimore oriole, bluebird, and others may be called by skilful whistling. The hunter has a call for plovers and sandpipers. He lures the wild turkey to its death by a call made of a wing-bone of one of its kind.

Calling them up.

A sound which often is quite successful with the smaller birds is made by moistening the lips and sucking in the breath, with the back or side of the hand placed over the mouth. A certain call thus made will deceive the blue jay in summer or winter. When a ruffed grouse or partridge with little chicks is discovered, you may keep the bird near you for some time by

crouching and imitating her squeal or the thin whistle of her young chicks. In the breeding season most birds are deceived by an imitation (made on the back of the hand) of the scream of a young bird. By making this sound in a thicket near a catbird's or robin's nest, it is easy to alarm these birds so that their cries will bring within view most of the other birds in the neighborhood. This "screeping" sound will sometimes entice birds out of a thicket at other seasons of the year. A yellow-breasted chat, thus called, almost alighted on my head. The crested flycatcher may be called in this way, even in the fall. Catbirds, thrashers, vireos, thrushes, and warblers all may be enticed by this call. If the observer is alone and well hidden, they will sometimes come within reach of his hand.

Utilizing the Curiosity of Birds.

A captive screech owl in a tree will cause a gathering of most of the small birds of the neighborhood, whether in wood or orchard. Even a tame crow, or tethered cat, may attract some birds in nesting time. Many birds evince an acute curiosity. When collecting birds in my boyhood I stalked my first sandhill crane nearly a mile on an open prairie. We were out of provisions, and living on the country. Meat was a necessity; so when venison or wild turkey were wanting we perforce must descend to roast crane, or baked owl. The bird was first seen from the timber feeding in the slough. Waiting until it had lowered its head after glancing around, I made a short run through the prairie grass and dropped, to give the bird another chance to reconnoiter. Advancing thus "by rushes," I gained the edge of the slough unseen, being then within two hundred yards of the bird. I waded in. Just then the bird raised its head. I fell flat in the two or three inches of water, and the crane flew off; but soon it swung its head to one side and looked back. Then, apparently, it began to wonder about the half-concealed thing lying there in the water. Slowly it swung round in a wide arc and came back, flying low, directly overhead. The thing in the water never moved until the crane had passed. Soon afterward the crane's skin changed owners, and a large slice off the bird's breast helped to fill a void that had held only two crackers that

day. It was but another illustration of a theory of Darwin and Wallace, — the survival of the fittest. Necessity knows no law but that of self-preservation. Still, if the ethics of the case are considered, no doubt the bird had the prior right to occupy that slough. Since then I have seen the great white heron, the great blue heron, the great white egret, the bald eagle, and several species of wild fowl manifest their curiosity in a similar way.

It is difficult for most birds to understand the meaning of a silent human figure lying prone and half concealed. While so reclining I have been closely approached by eagles and vultures. It is said that the fox sometimes will attract wild ducks within leaping distance by allowing its tail and back to show a little as it plays about in the long grass on the shore. A concealed hunter sometimes will attract wild fowl toward the shore by waving a red rag on the end of a stick, or by using a small dog trained to gambol in the grass.

Birds come to the silent sitter.

There are easier and pleasanter ways, however, of attracting the shy birds of the woods. "Nessmuk" says that there is an art which outflanks all wild animals, — the art of sitting on a log. This sylvan necromancy consists of sitting absolutely

still, and keeping both eyes and ears open. This will not generally succeed with wild fowl, except perhaps with the mergansers, the wood duck, the harlequin, and possibly a few others.

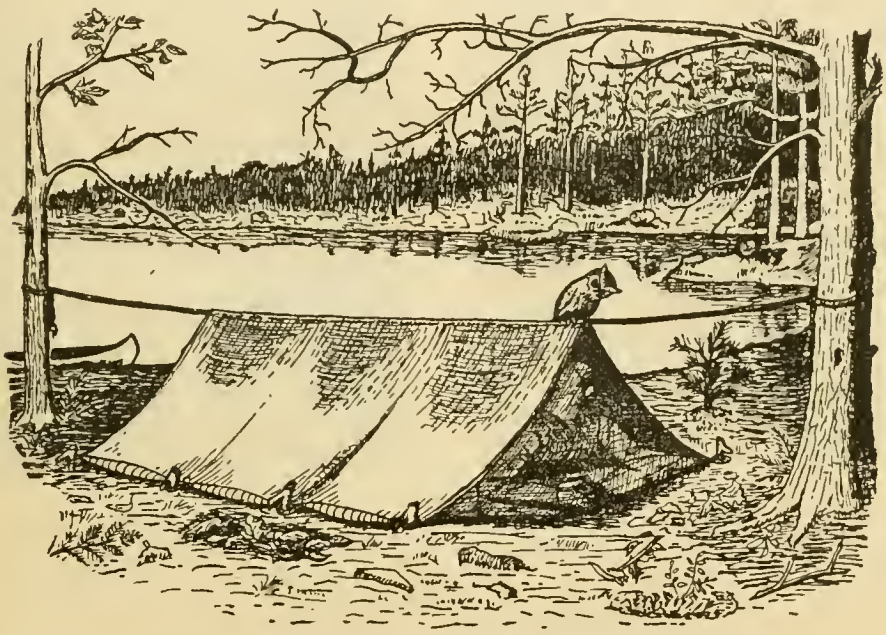
I once sat on a stone on the shore of the diminutive harbor of an island off the coast of British Columbia, and watched a flock of harlequin ducks swim around a little headland and come almost to my feet. Here the "lords and ladies," the handsomest of all sea ducks, played about for some time, showing off their plumage, throwing the sparkling drops from crest and wing; but at my first movement they beat the water into foam, sweeping away in a frenzy of affright.

Most river ducks cannot be deceived in this way. They will fly at first sight of man, so the observer must be well concealed. But all wood birds, both shy and rare, may be outgeneraled by the quiet sitter. They seem to wonder what manner of thing this is that looks so like a man, but neither smokes nor swears, talks, laughs, nor tramps about. Slowly they draw near and peer at the curiosity, and finally they apparently conclude it to be harmless, and go about their usual avocations.

While I have been writing this in the Concord woods a bright scarlet tanager has sung and hopped about for ten minutes on some branches about fifteen feet away, on a level with my face. A red-shouldered hawk has alighted on a limb five feet from the ground and seven paces away; two jays have chased a pair of red squirrels through the nearest tree; a black-throated green warbler has come to a branch just above my head and peered into my face; a black-billed cuckoo has surveyed me from all sides. The other day a sharp-shinned hawk swept up the hill and alighted on a limb before my cabin. He scanned the ground, the trees, the bushes by the river shore; but every little terror-stricken songster crouched concealed. Then the hawk caught the movement of my eyelid, sprang upon the air and swiftly glided downward and away, as noiselessly as he had come. Even the astute and wary crow will forget in time his characteristic caution, and indulge his curiosity enough to alight near by and scan the intruder nervously.

The Watcher's Protection from Insects.

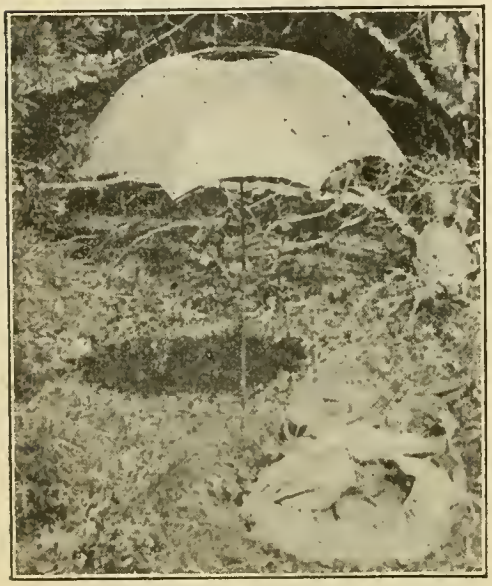
There is one great drawback, however, to this method. In summer our woods are infested with mosquitoes, as well as with gnats and flies. A pair of light leather gloves, a net or veil of a mesh smaller than ordinary mosquito netting, to wear over the hat and head, and a light blanket or wrap that can be carried in a shawl strap, will enable one to keep quiet and yet defy the troublesome insects. A light camp stool also is useful.



A screech owl visits the screen tent.

One who desires to camp in the summer woods will need a different outfit. For more than twenty years I have used a small "A" tent, made of olive-brown duck, with a flap to tuck under the blankets. It is seven feet long, four feet wide and three feet high. A small line is sewed along the top, which may be tied at each end to a tree or a stake to support the tent. Eight loops of heavy twine are staked down with forked sticks to hold out the sides. The ends are made of coarse cheesecloth, or fine netting, and the lower edges are provided with flaps to tuck under the blankets. A rubber blanket and a single light woolen one, with a cotton bag to be filled nightly with moss or grass for a pillow, complete the outfit, which may be rolled up and carried by a strap handle or "packed" above a knapsack. The

birds soon become accustomed to this tent, and even will alight upon it. For several evenings it was the favorite perch of a screech owl. From it I have watched the shore birds and seals on barren islands. In it I narrowly escaped being run over by two deer. The puma has circled around it, and once a wildcat actually walked on it, stepping on my breast.



Umbrella and cover cloth.

The blind in position.

"Hides" and "Blinds."

From such a tent, or from a screen of netting, you may watch the ruffed grouse, or partridge, and her callow brood. You may camp by a heronry and see the old birds come and go and feed their young. I have camped on a small dry mud bank in a great swamp, with no other dry land for miles around, being entertained by the nightly concerts of mosquitoes, ducks, herons, frogs and alligators, without the least discomfort or inconvenience.

There are shelters in which one may remain concealed, varying in construction from the log camp of the sportsman to the bough camp of the Indian or the "hide" or "blind" of the gunner. The umbrella blind used by bird photographers is an excellent device for watching birds if set up in the shade. In full sunlight on a hot day it is about as comfortable as a Turkish bath. If the birds to be watched are very wary, it is

best to set up the blind and leave it for several hours, or even a day, that they may become accustomed to it. The observer should be accompanied by one or more persons when he goes to conceal himself within it. When his companions leave, the birds' suspicions are allayed, and curiosity may impel them to a close approach. Wooden decoys used in connection with "blinds," and bird calls will enable an expert to lure most shore birds as near to him as they will come to the

Decoying shore birds.

gunner. A skilfully constructed blind placed on or near a long sandbar or point of the shore, and a few lumps of mud or turf judiciously distributed on the point, may enable one to get a good view of the several species of wild fowl. Apparently the flying birds at a distance mistake the clods for some of their own number, and come on, intending to alight. The best decoys are living birds anchored so that they can swim about. Sometimes a single grebe or duck in a small pond will attract a flock of several species. Many game birds and waterfowl may be baited with grain; but this is a method for those owning estates where birds can be protected, and should not be attempted by any bird student who would assemble the birds thus only to leave them to the tender mercies of the pothunter.

Those who wish to lure the sea birds may have some success with gulls by putting out fish or offal upon some beach or bar, near a blind; but gulls may be seen anywhere about the harbors of cities where they are not molested. They frequent all places where fish, offal, or garbage are thrown into the water. To attract the birds of the ocean, however, one must go several miles to sea, where, by throwing overboard cod livers, or some similar food, several species may be lured near the boat.

A Word to the Wise.

The two maxims at the close of this paper may be termed "A word to the wise." The foolish will not heed them.

Science is truth. Its records must be based on facts. Therefore if you report your findings, you should be sure, first, that they are authentic. A fertile imagination is a great gift, useful for the writer of fiction, but it has no place in bird study. A "creative memory" is not an asset for the bird student. Many people make mistakes in the identity of birds seen in the field. The rose-breasted grosbeak and the scarlet tanager have been reported here in winter. There are no other North American birds that resemble either of them. It would seem impossible to mistake these birds. But it is well known that the scarlet tanager winters in South America, and that the rose-breasted grosbeak winters from southern Mexico southward into South America. Therefore it is highly improbable that any report of these birds wintering in this region is correct. Somebody must have been mistaken.

Mistakes in field identification are made not only by novices, but by experienced ornithologists. Years ago, when the passenger pigeon had disappeared from New England, three of America's eminent ornithologists visited one of the last localities frequented by this bird in Connecticut. Two of these gentlemen have filled the position of president of the American Ornithologists' Union; the other was a well-known local ornithologist. Immediately upon arriving on the ground the first two gentlemen identified some birds seen as passenger pigeons. The local ornithologist asserted that they were mourning doves. Some one was mistaken. Finally the birds flew away, and to this day no one absolutely knows whether these birds were mourning doves or passenger pigeons. For several years rewards aggregating $3,000 were offered for the undisturbed nest and eggs of the passenger pigeon. Although many people claimed the reward, no one actually found the nest. The American continent was searched, but no one was able to produce even so much as a feather of the passenger pigeon. Nevertheless, every few weeks some one reports having seen passenger pigeons. While there may be still some passenger pigeons on earth, it does not seem probable.

Owing to the general interest in birds, ornithologists receive communications from many people stating that they have seen rare birds, or asking that birds be identified from their descriptions. Often these descriptions are so incomplete that it is impossible for any one to identify birds from them, and many times they describe no bird living on this earth. Some of the descriptions may be derived from escaped cage birds, others from freaks, such as hybrids or partially melanistic or albinistic specimens. In any case, the description should be complete, otherwise the time of both describer and expert is wasted. I realize the difficulties under which beginners labor. There are no adequate illustrations of all plumages of all North American birds, nor are there any adequate descriptions of all. The best that we have are those in Ridgway's "Birds of North and Middle America," and that is not yet complete (1919). The collections of birds in both public and private museums in this country also are inadequate, and few men have a knowledge of ornithology sufficient to enable them to recognize at sight the different plumages of most North American birds, to say nothing of those of other countries, some of which may find their way here, while others may escape from confinement and be found at large. It is evident, then, that in asking an ornithologist to identify by description, a bird that you do not know, you may be presenting a problem indeed. Therefore, (1) when seeking light on the identification of a bird, never trouble an ornithologist with an inadequate description; also, (2) be sure of the identity of a bird before you report its occurrence as a fact.

The Commonwealth of Massachusetts

STATE DEPARTMENT OF AGRICULTURE

WILFRID WHEELER, Commissioner

DEPARTMENT CIRCULAR No. 13

SUPERSEDING CIRCULAR No. 49

August, 1919

Plants that Attract and Shelter Birds

AND

Some that Protect Cultivated Fruit

EDWARD HOWE FORBUSH

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

Publication of this Document
approved by the
Supervisor of Administration

ORNAMENTAL AND OTHER PLANTS USED TO ATTRACT BIRDS AND PROTECT CULTIVATED FRUIT.

Introduction.

The Arnold Arboretum at Boston has become noted as a resort for birds. Probably the number and variety found there are not exceeded in any upland locality in New England. Any observing person frequenting the Arboretum can see for himself that birds are attracted there by the diversity of plants, which support a great variety of insects and produce quantities of fruit and seeds, thus affording birds an unusual abundance and variety of animal and vegetal food. Notwithstanding the advantages that birds find at the Arboretum, it would be possible for any one owning a large estate to attract to it many more than are found there. This could be accomplished in part by selecting certain plants, and planting them in such a way as to provide both food and protection.

It would be well for the farmer and the orchardist to make their home grounds especially attractive to useful birds. And all who live in the country or in the suburbs, and even some who reside in cities, may, if they will, utilize plants to attract birds. Landscape architects and gardeners who lay out the grounds of large estates often plant quantities of shrubs and trees without considering the needs of birds. While there are ornamental flowering plants that birds frequent, there are many also that bear highly colored and decorative fruit on which birds feed. Nearly all such plants may be utilized in beautifying country estates. There should be fruit-bearing shrubbery and vines and dense hedges or tangles of ornamental fruiting plants. Coniferous trees may be planted to best advantage in small patches or rows as windbreaks, for large groves of such trees are likely to shelter hawks, crows, squirrels and other enemies of birds.

The up-to-date fruit grower should never plant an orchard or attempt to cultivate small fruit without first providing rows of early wild fruit to attract birds away from his cultivated varieties. Otherwise, unless there is a quantity of wild fruit growing in the neighborhood, birds are likely to reduce his profits. The problem of attracting native birds in New England has been complicated by the introduction from Europe of the starling. This species is now locally common or even abundant, and its flocks devour quantities of wild fruit which otherwise might serve as food for native birds, which are thus deprived of much fruit intended for them, especially during the inclement days of winter. Therefore, it is imperative now to provide much more food for them than ever before.

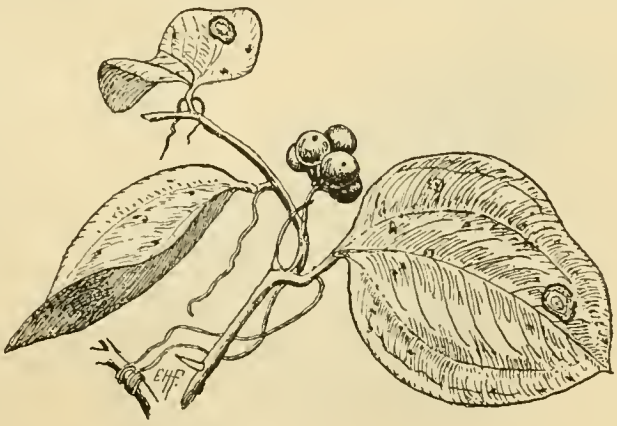
Plants Attractive to Fruit-eating Birds.

Farmers know that certain birds are fond of the earliest cherries and strawberries, and that some will feed voraciously on raspberries and blackberries unless there is other more attractive food near. Therefore, if fruit is wanted only for home use it is well to plant enough for the family and the birds. If cultivated small fruits are planted in quantity, all the fruit-eating birds of the neighborhood will be there when the fruit is ripening. But there are other fruits even more attractive to birds. First among these for early summer are the wild strawberry (*Fragaria americana*), the Juneberry or service-berry (*Amelanchier canadensis*), the red-berried elder (*Sambucus racemosa*) and the white mulberry (*morus alba*). The wild strawberry fruits as early as the cultivated varieties, and it lasts longer. The Juneberry is earlier than the earliest cherries, and is supposed to hang later, but in my experience the birds get all the Juneberries before July 4, and if gray squirrels are very numerous they are likely to take the fruit even before it becomes ripe enough for the birds. This is a fine

Tupelo or sour gum.

fruit to cultivate for human food could the birds and squirrels be kept away from it. The red-berried elder begins to fruit early in June, bears fruit well through July, and like the common elder (*Sambucus canadensis*), which fruits in Massachusetts in August and September, is one of the chief attractions for summer birds More than one hundred species are known to feed upon elderberries. Close to the elders in attractiveness come the cornels or dogwoods. These are summer fruiting plants. All the mulberry trees are extremely inviting to birds. The native red mulberry (*Morus rubra*) is useful but does not fruit quite so early in June as the introduced white mulberry (*Morus alba*). The Russian mulberry has been widely recommended, attracts birds remarkably, and in some cases has been established in Massachusetts, but it appears not to be hardy on the higher lands of the State, and seems to require special treatment to establish it here. The Downing (or the New American, which appears to be identical) is a cultivated variety with a fruit that is much more palatable than the common kinds, and has been successfully grown here. The dwarf white mulberry also seems hardy and gives a crop of fruit a few years after planting.

The mulberries make fine shade and ornamental trees, but should not be planted where they will overhang walks or buildings, as the decaying juicy fruit, if not all eaten by birds, drops to the ground in summer, where it is crushed by the feet of passers-by and disfigures walks or stains clothing. Wild blackberries, raspberries, blueberries and huckleberries all are eaten by birds in summer and all attract them. All wild cherries tempt the birds in July, August or September. There is a prejudice against these trees because they harbor tent caterpillars, which, however, may be killed by early spraying, but if wild cherries are not present on our grounds many



Smilax, greenbrier, bull brier.

birds will be likely in August and September to go where they can be found or to attack cultivated fruit. Any crusade for the extermination of wild cherry trees will fail, as they may be found not only in yards, fields, pastures and along the roadsides, but almost everywhere in the woods.

In September or October practically all the later wild fruits ripen, and, as many of them remain on the stems all winter, and some until spring, it is only necessary to have them in sufficient variety to provide food for fruit-eating birds throughout the winter. A few of these fruits, however, are particularly important as well as ornamental. Some are not eaten much by birds while the softer and more desirable fruits are at their best, but later they remain intact during the inclement months, when frost and storms have destroyed or covered other fruit, and then they offer nutriment to the birds in time of need. Such are the fruits of the American and European mountain ash, the various sumacs, the junipers, the smilax, holly, hawthorn, bayberry, snowberry, barberry, and the black alder. The fruit of the mountain ash is very rich and ornamental in color, and rarely is cleaned up by birds until the dead of winter, when they seek it eagerly. The foliage of the sumacs is brilliant in autumn, while the fruit, as well as that of the black alder, is handsome and remains on the stem for the winter birds. The catkins of the birches and of the common alder are sought for their seeds by winter birds. It is essential to provide berries and seeds on shrubs and trees well above the snow for winter food.

Virginia juniper or red cedar.

All trees that are attacked by many insects are favorites with birds. Many hundreds of species of insects infest the apple, oak, poplar, willow, birch and alder. Hence these trees are visited by many birds. The coniferous trees are not subject to the attacks of such a variety

of insects, nevertheless certain species sometimes become numerous upon them. The white pine is a favorite with titmice and kinglets in winter, as they often find the eggs of aphides on these trees in enormous numbers. The seeds of coniferous trees are eaten by a few species of birds. Larches and spruces attract crossbills while the former are favorites of goldfinches. Elms ripen their seeds early, thus providing food for birds in early summer, while the spanworms that infest elms and apple trees are sought by nearly all birds.

Mr. W. L. McAtee of the Biological Survey, who has made a special study of fruits attractive to birds, has published in Farmers' Bulletin 912 the following table to show the relative attractiveness to birds of certain genera of fruits. Following Table 1 we reproduce another table from Farmers' Bulletin 621, entitled "How to attract Birds in Northeastern United States," showing the seasons in which certain fruits are available for birds. These and the succeeding lists of plants have been slightly changed and adapted to the present publication, but mainly by bringing the botanical names more nearly to date.

TABLE 1. — *Preferences of Birds among Genera of Fleshy Fruits.*

Common Name.	Scientific Name.	Number of Species of Birds known to eat the Fruit.[1]
Juniper; red cedar,	*Juniperus,*	36
Greenbrier,	*Smilax,*	38
Bayberry,	*Myrica,*	64
Hackberry,	*Celtis,*	38
Mulberry,	*Morus,*	52
Pokeberry,	*Phytolacca,*	48
Barberry,	*Berberis,*	10
Spicebush,	*Benzoin,*	17
Sassafras,	*Sassafras,*	15
Currant; gooseberry,	*Ribes,*	30
Strawberry,	*Fragaria,*	42
Raspberry; blackberry,	*Rubus,*	114
Rose,	*Rosa,*	17
Mountain ash,	*Sorbus,*	14
Chokeberry,	*Aronia,*	13
Red haw,	*Cratægus,*	30
Juneberry,	*Amelanchier,*	38
Cherry; plum,	*Prunus,*	66
Sumac,[2]	*Rhus,*	76
Holly,	*Ilex,*	38
Supple-jack,	*Berchemia,*	12
Buckthorn,	*Rhamnus,*	16
Grape,	*Vitis,*	71
Virginia creeper,	*Parthenocissus,*	39
Buffalo berry,	*Shepherdia,*	13

[1] When ten or more. [2] Nonpoisonous species.

TABLE 1. — *Preferences of Birds among Genera of Fleshy Fruits* — Con.

COMMON NAME.	Scientific Name.	Number of Species of Birds known to eat the Fruit.
Wild sarsaparilla,	*Aralia*,	14
Dogwood,	*Cornus*,	79
Sour gum,	*Nyssa*,	36
Bearberry,	*Arctostaphylos*,	12
Huckleberry,	*Gaylussacia*,	30
Blueberry,	*Vaccinium*,	62
Mexican mulberry,	*Callicarpa*,	10
Partridge berry,	*Mitchella*,	10
Elder,	*Sambucus*,	101
Snowberry,	*Symphoricarpos*,	22
Black haw,	*Viburnum*,	26
Honeysuckle,	*Lonicera*,	15

TABLE 2. — *Seasons of Fruits attractive to Birds.*

Common Name.	Scientific Name.	Native or introduced.	Fruiting season.											
			Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Juniper,	*Juniperus communis,*	Native												
Red cedar,	*Juniperus virginiana,*	Native												
Greenbrier,	*Smilax rotundifolia,*	Native												
Bayberry,	*Myrica carolinensis,*	Native												
Hackberry,	*Celtis occidentalis,*	Native												
Red Mulberry,	*Morus rubra,*	Native												
White mulberry,	*Morus alba,*	Introduced												
Pokeweed,	*Phytolacca decandra,*	Native												
Barberry,	*Berberis vulgaris,*	Introduced												
Sassafras,	*Sassafras variifolium,*	Native												
Spicebush,	*Benzoin æstivale,*	Native												
Wild gooseberry,	*Ribes cynosbati,*	Native												
Red currant,	*Ribes vulgare,*	Introduced												
Asiatic currant,[1]	*Ribes fasciculatum,*	Introduced												
Flowering crab apple,	*Pyrus floribunda,*	Introduced												
Chokeberry,	*Aronia melanocarpa,*	Native												
Mountain ash,	*Sorbus americana,*	Native												
Juneberry,	*Amelanchier canadensis,*	Native												
Asiatic service-tree,[2]	*Amelanchier asiatica,*	Introduced												
Cockspur thorn,	*Cratægus crus-galli,*	Native												
Washington thorn,	*Cratægus phænopyrum,*	Introduced												
English thorn,	*Cratægus oxyacantha,*	Introduced												
Wild strawberry,	*Fragaria americana,*	Native												
Wild blackberry,	*Rubus allegheniensis,*	Native												
Wild blackberry,	*Rubus triflorus,*	Native												
Wild blackberry,	*Rubus canadensis,*	Native												
Pasture rose,[1]	*Rosa humilis,*	Native												
Wild black cherry,	*Prunus serotina,*	Native												
Wild red cherry,	*Prunus pennsylvanica,*	Native												
Beach plum,[1]	*Prunus maritima,*	Native												

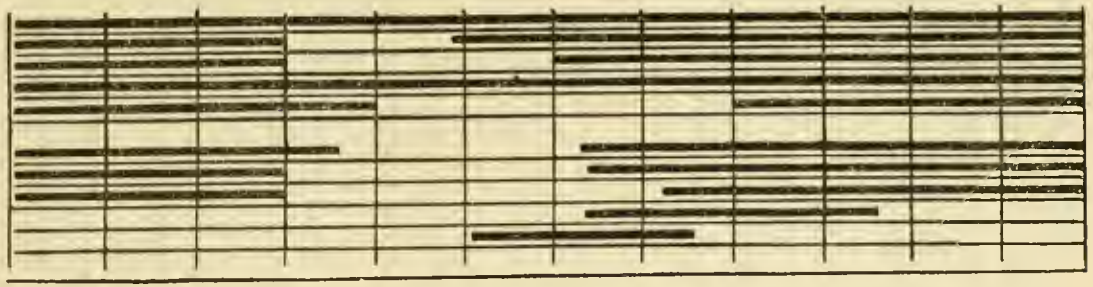
[1] Fruit becoming dry at end of season.

[2] Apparently procurable only from foreign dealers.

TABLE 2. — *Seasons of Fruits attractive to Birds* — Concluded.

Common Name.	Scientific Name.	Native or introduced.	Fruiting season.											
			Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sand cherry,	*Prunus pumila,*	Native												
Crowberry,	*Empetrum nigrum,*	Native												
Smooth sumac,	*Rhus glabra,*	Native												
Fragrant sumac,	*Rhus canadensis,*	Native												
Holly,[1]	*Ilex opaca,*	Native												
Inkberry,[1]	*Ilex glabra,*	Native												
Black alder,[1]	*Ilex verticillata,*	Native												
Mountain holly,[1]	*Nemopanthus mucronata,*	Native												
Bittersweet,	*Celastrus scandens,*	Native												
Buckthorn,	*Rhamnus cathartica,*	Introduced												
Virginia creeper,	*Parthenocissus quinquefolia,*	Native												
Japanese creeper,[2]	*Parthenocissus tricuspidata,*	Introduced												
Summer grape,[2]	*Vitis æstivalis,*	Native												
Frost grape,	*Vitis vulpina,*	Native												
Leatherwood,	*Dirca palustris,*	Native												
Wild pepper,	*Daphne mezereum,*	Introduced												
Oleaster,[2]	*Elæagnus angustifolia,*	Introduced												
Buffalo berry,	*Shepherdia canadensis,*	Native												
Wild sarsaparilla,	*Aralia nudicaulis,*	Native												
Asiatic sarsaparilla,[2]	*Acanthopanax sessiliflorum,*	Introduced												
Bunchberry,	*Cornus canadensis,*	Native												
Flowering dogwood,	*Cornus florida,*	Native												
Red osier,[2]	*Cornus stolonifera,*	Native												
Alternate-leaved dogwood,	*Cornus alternifolia,*	Native												
Sour gum,	*Nyssa sylvatica,*	Native												
Wintergreen,	*Gaultheria procumbens,*	Native												
Bearberry,	*Arctostaphylos uva-ursi,*	Native												
Creeping snowberry,	*Chiogenes hispidulus,*	Native												
Black huckleberry,	*Gaylussacia baccata,*	Native												
Early sweet blueberry,	*Vaccinium pennsylvanicum,*	Native												
Swamp blueberry,	*Vaccinium corymbosum,*	Native												
Cranberry,	*Vaccinium macrocarpon,*	Native												
Persimmon,[1]	*Diospyros virginiana,*	Native												
Privet,	*Ligustrum vulgare,*	Introduced												
Purple berry,	*Callicarpa purpurea,*	Introduced												

Partridge berry,	*Mitchella repens,*	Native
Fly honeysuckle,[2]	*Lonicera cœrulea,*	Native
Tartarian honeysuckle,[2]	*Lonicera tatarica,*	Introduced
Snowberry,	*Symphoricarpos racemosus,*	Native
Coralberry,	*Symphoricarpos vulgaris,*	Native
High-bush cranberry,	*Viburnum opulus,*	Native
Arrowwood,	*Viburnum acerifolium,*	Native
Sheepberry,	*Viburnum lentago,*	Native
Common elder,	*Sambucus canadensis,*	Native
Red-berried elder,	*Sambucus racemosa,*	Native



[1] Sexes tending to be on separate plants: both required.

[2] Fruit becoming dry at end of season.

The plants given in the above list are selected from a much larger number, all of which are known to be favorites with birds, and are such as are likely to be secured through the ordinary channels of trade. The fruiting seasons include the earliest and latest dates recorded for New York and New England, and it cannot be expected that fruit will be available at any one locality throughout the entire season given, unless a large number of plants are set in a variety of situations. Mr. McAtee also gives the following valuable notes on the foregoing list: —

Bayberry. Usual trade name is *Myrica cerifera*. Now known to botanists as *M. carolinensis*.

Hackberry. Fruit scarce in late May and June. *Celtis serrata*, *C. bungeana* or *C. mississippiensis* may be substituted.

Mulberry. *Morus tatarica* may be used.

Pokeweed. Let it grow through shrubs or a trellis which will support it in winter.

Barberry. *Berberis amurensis*, *B. aristata*, *B. regeliana* and *B. rehderiana* are good substitutes. The universally planted *B. thunbergii* seems to be of very little value as bird food.[1]

Sassafras. Appears in most catalogues as *S. officinale* or *S. sassafras*.

Flowering apple. The following may be substituted: *P. baccata*, *P. halliana*, *P. parkmanii*, *P. sargentii and P. toringo*.

Chokeberry. Often called *Pyrus* or *Aronia nigra*. *P. arbutifolia*, another native species, retains its fruit just as long, but the fruit becomes very dry toward the end of the season.

Cherry. *Prunus cerasifera*, *P. fruticosus*, *P. japonica pendula*, *P. sargentii* and *P. tomentosa*, all introduced, are worth adding.

Sumac. *Rhus copallina* or *R. hirta* (*typhina*) may be substituted for *R. glabra*.

Juneberry. *Amelanchier canadensis*, sold by nurserymen, is a composite species. Several species are now recognized, among which *A. lævis* is a notably early fruiter and *A. sanguinea* a late one. Some fruit of June berries occasionally hangs much later than the season indicated, but in very dry condition.

Thorns. The species recommended are those usual in the trade. So far as desirability is concerned many native species could be substituted. Cotoneasters, such as *C. coccinea*, *C. horizontalis*, *C. microphylla*, *C. rotundifolia* and *C. tomentosa*, may also be used.

Strawberry. Often called *Fragaria vesca* var. *americana*. *F. virginiana* is a fair substitute. Little dealt in; must usually be transplanted from woods and fields.

---

[1] Although this sentence probably was true when first written, many birds turned to these berries in the hard winter of 1917–18. Mockingbirds seek them and bluebirds feed on them during the cold waves of early spring. E. H. F.

Blackberry. *Rubus triflorus* is frequently called *R. americanus.*

Rose. All native species have persistent fruit. The small-fruited ones are best for birds. *Rosa carolina* and *R. nitida* are suitable for low grounds, and *R. humilis* (sometimes called *virginiana*) and *R. setigera* may be planted in drier places. *R. micrantha* and *R. multiflora* are among the best introduced roses.

Black alder. *Ilex lævigata* may be used instead of *I. verticillata. I. serrata* is a good introduced species.

Mountain holly. Drops most of its berries in the fall; only a few persist throughout the season indicated.

Bittersweet. *Celastrus orbiculatus,* introduced, may be used.

Buckthorn. *Rhamnus dahurica* is equally good.

Virginia creeper. Often sold under the names *Ampelopsis* and *Parthenocissus. A. heterophylla* and *P. vitacea* may be substituted.

Wild pepper. *Hippophaë rhamnoides* may replace it, especially along coast.

Oleaster. *Elæagnus longipes, E. multiflora, E. parviflora* and *E. umbellata* also are good.

Buffalo berry. *Shepherdia* (*Lepargyrea*) *argentea,* the true buffalo berry, furnishes good bird food.

Dogwood. *Cornus racemosa,* native, and *C. alba* and *C. sanguinea,* introduced, are worthy substitutes.

Huckleberry. *Gaylussacia baccata* is often sold as *G. resinosa.*

Blueberry. Any species may be substituted.

Cranberry. Generic name often given as *Oxycoccus.*

Privet. *Ligustrum acuminatum, L. amurense, L. ciliatum, L. ibota* and *L. microcarpum,* all introduced, are equally good. Must not be clipped; berries borne on outer twigs.

Purple berry. Variety *japonica* is the hardy form.

Honeysuckle. *Lonicera glauca, L. canadensis, L. oblongifolia* and *L. sempervirens,* native, and *L. maackii,* introduced, may be substituted.

Snowberry. *Symphoricarpus occidentalis* is just as good.

Viburnum. *V. dentatum,* native, and *V. sieboldii,* introduced, are worth adding.

Elder. *Sambucus nigra,* introduced, also is valuable.

It will be noted that the list given by Mr. McAtee includes both native and introduced species, but for those who prefer to raise their own plants, or to encourage such native plants enticing to birds as already grow on their land, the following list, first published by Mr. F. H. Kennard in "Bird-Lore" for July–August, 1912, is recommended as showing the comparative attractiveness of the various species in Massachusetts.

Those plants that are particularly tempting to birds are shown with three asterisks, while those with more than ordi-

nary attractiveness are shown by one or two asterisks, in the order of their attractiveness; and those species of which the fruits seem to be eaten so seldom as to make their planting barely worth while are marked with a dagger.

Deciduous Trees.

**Acer negundo*, ash-leaved maple, box elder.
***Acer saccharum*, sugar maple; and doubtless other maples.
Betula populifolia, American gray birch.
Betula lutea, yellow birch; and probably other birches.
Celtis occidentalis, hackberry.
Cercis canadensis, red-bud.
****Cornus florida*, flowering dogwood.
†*Corylus americana*, American hazel.
***Cratægus coccinea*, white thorn.
***Cratægus crus-galli*, cockspur thorn; and others of this genus.
†*Fagus grandifolia*, American beech.
**Fraxinus americana*, American white ash; and probably other species.
†*Hicoria* sp. Several kinds of hickory.
Ilex opaca, American holly.
†*Liquidambar styraciflua*, sweet gum.
†*Liriodendron tulipifera*, tulip tree.
****Morus rubra*, native red mulberry.
***Nyssa sylvatica*, tupelo.
Ostrya virginiana, hornbeam.
†*Platanus occidentalis*, sycamore.
†*Populus* sp. Various species of poplars are sometimes fed upon.
****Prunus pennsylvanica*, bird cherry.
****Prunus pumila*, sand cherry.
****Prunus serotina*, black cherry.
****Prunus virginiana*, choke cherry.
***Sorbus americana*, mountain ash.
†*Quercus* sp. Several species of oaks.
Sassafras variifolium, sassafras.
Ulmus americana, American elm.
And other species.

Evergreen Trees.

***Juniperus virginiana*, red cedar.
***Juniperus communis*, prostrate juniper.
***Picea canadensis*, white spruce.
***Picea rubra*, red spruce; and undoubtedly other species.
**Pinus rigida*, pitch pine.
**Pinus strobus*, white pine.
**Tsuga canadensis*, hemlock.

Shrubs.

***Amelanchier canadensis*, Juneberry.
***Benzoin æstivale*, spicebush.
**Berberis vulgaris*, barberry.
Comptonia asplenifolia, sweet fern.
Corema conradii, broom crowberry.
****Cornus alternifolia*, blue cornel.
****Cornus candidissima*, gray cornel.
****Cornus sericea*, silky cornel.
****Cornus stolonifera*, red osier cornel.
***Gaylussacia frondosa*, dangleberry.
***Gaylussacia baccata*, huckleberry.
***Ilex glabra*, inkberry.
***Ilex verticillata*, black alder; and probably *I. lævigata*, winterberry, black ilex.
Ligustrum vulgare, privet.
***Myrica cerifera*, bayberry.
Prunus maritima, beach plum.
**Aronia arbutifolia*, chokeberry.
Rhamnus catharticus, buckthorn.
****Rhus copallina*, shining sumac.
****Rhus glabra*, smooth sumac.
****Rhus toxicodendron*, poison ivy.
****Rhus typhina*, staghorn sumac.
****Rhus vernix*, poison sumac.
***Ribes americanum*, large-flowering currant.
***Ribes lacustre*, swamp gooseberry; and other species.
***Rosa*, sp. It is probable that the fruits of all the native wild roses are eaten largely by birds.
****Rubus occidentalis*, thimbleberry.
****Rubus strigosus*, red raspberry.
****Rubus canadensis*, low blackberry.
****Rubus villosus*, high blackberry.

****Sambucus canadensis*, common elder.
****Sambucus pubens*, panicled elder.
Shepherdia canadensis, shepherdia.
***Symphoricarpos racemosus*, snowberry.
****Vaccinium cæspitosum*, dwarf bilberry.
****Vaccinium corymbosum*, high-bush blueberry.
****Vaccinium pennsylvanicum*, low-bush blueberry; and doubtless other species, including *V. vitisidæa*, cowberry.
***Viburnum alnifolium*, hobble bush.
***Viburnum dentatum*, arrow-wood.
***Viburnum lentago*, sheepberry.
***Viburnum nudum*, withe-rod.
***Viburnum opulus*, high-bush cranberry.
***Viburnum prunifolium*, black haw; and doubtless *V. acerifolium*, *V. cassinoides*, and other species.

Vines.

***Parthenocissus quinquefolia*, Virginia creeper.
Arctostaphylos uva-ursi, bearberry.
Celastrus scandens, false bittersweet.
Menispermum canadense, moonseed.
Mitchella repens, partridge berry.
Vaccinium macrocarpon, cranberry.
Vaccinium oxycoccus, dwarf cranberry.
**Smilax rotundifolia*, bull brier.
***Vitis cordifolia*, frost grape.
***Vitis labrusca*, fox grape.
***Vitis vulpina*, frost grape.

Herbaceous Plants.

***Aralia nudicaulis*, sarsaparilla.
Fagopyrum esculentum, buckwheat.
***Fragaria virginiana*, strawberry.
Gaultheria procumbens, checkerberry.
Helianthus annuus, sunflower.
***Phytolacca decandra*, pokeberry.
Smilacina racemosa, false spikenard.
Solanum nigrum, nightshade.

It should be noted that the poison ivy and the poison sumac are undesirable for indiscriminate planting, and that the barberry, although generally regarded as a native, is, as Mr. Kennard remarks, an introduced species.

The first deciduous tree on the above list, the ash-leaved maple or box elder, is noteworthy as a favorite of the evening grosbeak while wintering here, and it seems probable that since this beautiful bird has become a winter resident here in recent years it might be induced to come and remain in larger numbers if many of these trees were planted.

The American beech, while not very attractive to small birds, furnishes in its fruit a supply of food in autumn for ducks and grouse. The oaks, which supply much insect food for many birds, also furnish food in the form of acorns for ducks, grouse, jays and crows. The hornbeam probably is more important than Mr. Kennard's marking indicates. Among the birds that feed on its seeds are the cardinal grosbeak and the ruffed grouse. My own experience goes to show that *Cornus alternifolia* is most important among the cornels. The Virginia

creeper or woodbine is useful, as its fruit is sought by thrushes. Among the herbaceous plants the pokeweed and the sunflower may be mentioned as favorites with birds. When raising sunflowers the giant Russian variety is best. If well fertilized it produces gigantic flowers and a large quantity of huge seeds which are much sought after by the brilliant goldfinch, the purple finch, the nuthatches and the chickadee. Buckwheat always attracts the mourning dove and is likely to lure bob-white.

Food Plants for Native Sparrows and Ground Birds.

All native sparrows are fond of weed seeds. Doves, grouse, bob-whites and pheasants eat them also and wild fowl resort to them more or less. Hence weedy cultivated fields and gardens are favorite haunts for seed-eating birds in autumn.

I have found nothing better for attracting native sparrows than the Japanese millet (*Panicum crus-galli*), a cultivated weed or barnyard grass. A small patch of this sowed on land that has first been plowed, harrowed well and manured will attract all the native sparrows in the neighborhood when the seed ripens, as well as the migratory species from the north. If several patches be sown from early May to late June in different localities they will ripen their seed at different times and provide food from late August until winter. Mr. McAtee recommends also the following for sparrows: —

"Love-lies-bleeding (*Amaranthus caudatus*), prince's feather (both *Amaranthus hypochondriacus* and *Polygonum orientale*), yellow chamomile (*Anthemis tinctoria*), chamomile (*Anthemis nobilis*), *Calandrinia umbellata*, bachelors button (*Centaurea cyanus*), African millet (*Eleusine coracana*), California poppy (*Eschscholzia californica*), tarweed (*Madia elegans*), miners lettuce (*Montia perfoliata*), millet (*Panicum miliaceum*), . . . German millet or Hungarian grass (*Setaria italica*), and sunflower. Several of the species of sunflower will serve, the common sunflower (*Helianthus annuus*) being one of the best, having named varieties especially prized for the abundance and large size of the seed. No seeds are more relished by graminivorous birds than the millets; in fact, they are so much preferred that they have been used with good effect for drawing the attention of birds from more valuable grain crops." [1]

[1] McAtee, W. L., Plants Useful to attract Birds and protect Fruit. Year book, United States Department of Agriculture 1909, p. 193.

In my "Useful Birds and their Protection," fourth edition, 1913, published by the Massachusetts State Board of Agriculture, two lists of plants attractive to birds are given, pages 374 to 376 and pages 430 to 432. For lack of space and because they would largely duplicate the two lists above they cannot be repeated here, nor can the long lists of food plants of the ruffed grouse and bob-white, printed in my "Game Birds, Wild Fowl and Shore Birds," be included in this circular, but for the convenience of those who wish to attract game birds the following by Mr. McAtee from the Yearbook of the United States Department of Agriculture for 1909 is appended: —

While the establishment of preserves for land game birds is yet a new movement in this country, it is certain to become of great importance. Hence it is desirable to disseminate information as to the food and covert plants that are favored by the grouse and quail. Bob-whites frequently use covers of rose, alder and blackberry bushes, and thickly set barberry, bayberry and dense banks of honeysuckle are suitable. These plants also furnish food for the birds, but they should be supplemented by others more exclusively adapted for this purpose. Sumac, Japanese clover, buckwheat, sorghum, millet, vetches, cowpeas, and any plants of the pea family producing small seeds are valuable, and should be sown in large quantities. The seeds of milk pea (*Galactia*), partridge pea (*Chamœchrista*), hog peanut (*Falcata*), wild bean (*Strophostyles*), and smartweeds (*Polygonum*) are important natural foods of the eastern quail, but should be encouraged only where they cannot become weed pests. The western quail are fond of the seeds of sumac, bur clover, alfilaria, lupines, napa thistle and turkey mullein plants; but where these plants are liable to become nuisances the food plants recommended for the eastern quail will serve.

Coverts for grouse, as the sharptail, should abound in such plants as rose, sumac, blueberry, bearberry, buffalo berry, dwarf birch and alder. The ruffed grouse thrives among scrub oak, bayberry, rose, sumac, dwarf birch, alder, poplar, willow and such fruit-bearing plants as partridge berry, hawthorn, viburnum, wild grapes, mountain ash, blueberry, blackberry and cranberry. Cover of this nature is suited to the heath hen also, and to the imported pheasants and the Hungarian partridge, but in all cases it is well to supplement the food supply furnished by these shrubs and trees by planting small grains and legumes, as recommended for quail.

Some of the plants named in the above list are not native to New England, and probably the cowpea and the milk pea will not mature in Massachusetts, but most of them may be utilized here.

It is impossible within the limits of this circular to give even a list of the important plants which attract wild ducks and geese, but information regarding some of the most useful of such plants may be found in the following publications of the United States Department of Agriculture: Bureau of Biological Survey, Circular 81, and Department of Agriculture Bulletins 58 and 205. All may be obtained of the Superintendent of Documents, United States Department of Agriculture, Washington, District of Columbia.

Plants for Protecting Cultivated Fruits.

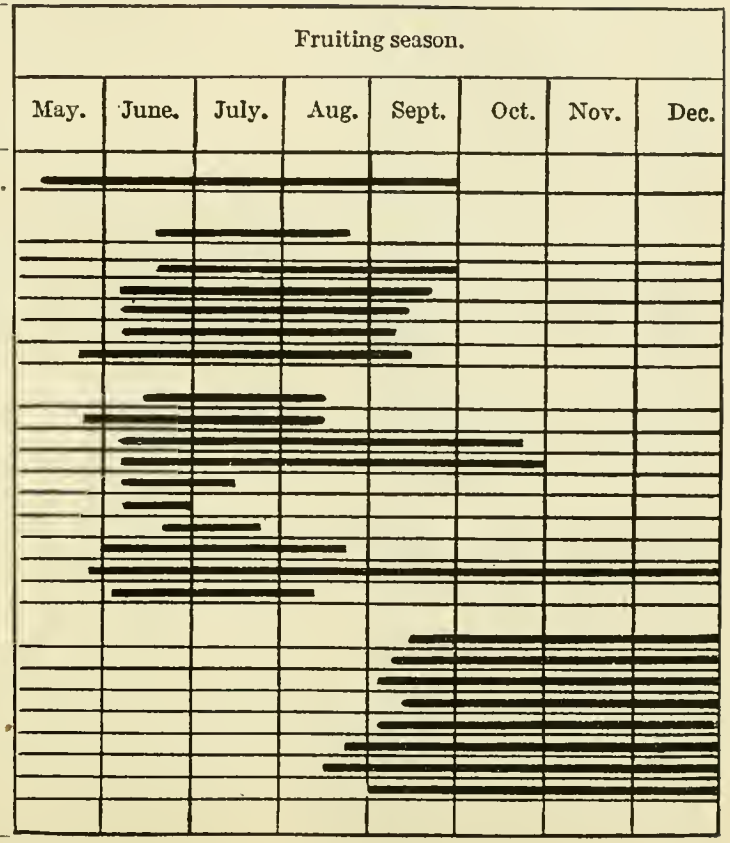
The chief fruit-eating birds in Massachusetts are the robin, the catbird and the cedar waxwing. The flicker, English sparrow, Baltimore oriole and a few other species occasionally are mischievous, and the starling, a recent introduction from the Old World, seems likely to become most destructive of all. Cherries are most often attacked by fruit-eating birds, but all small fruits are eaten by them. It is not good biology to shoot birds for taking fruit. It is better to provide fruit enough for ourselves and the birds, and thus retain their services as insect destroyers. It will pay the fruit grower to lure them away from his cultivated cherries and berries, if possible, by setting out plants that bear earlier and more attractive fruit. My experiments with the native red mulberry were successful in protecting cherries, and I have watched a garden where a single tree of the Downing mulberry entirely protected several trees of cultivated cherries of the harder varieties. No native bird troubled the cherries although the English sparrows occasionally pecked one. I have learned from fruit growers in New Jersey that mulberry trees protected their cherry crops from robins even in a very dry season, when robins elsewhere had been destructive to the fruit. The Russian mulberry is very early and will grow in southeastern Massachusetts. Elsewhere in the State, as hereinbefore stated, the white mulberry, the red or the Downing or New American would serve. The advantages of the Downing or New American are that it is a quick grower and fruiter, bears very early in the season and appears to be perfectly hardy, at least in eastern Massachusetts.

Mr. G. T. Powell tried the experiment of planting a row of soft early cherries known as the Governor Wood. The birds took them, leaving untouched choice varieties, such as Montmorency and Richmond. Another fruit grower, having a row of soft cherries and finding that the birds took most of them, cut down the trees. The birds then attacked the main orchard.

Mr. McAtee in Farmers' Bulletin 621 gives the following table, showing the seasons of fruits useful in protecting cultivated varieties: —

TABLE 3. — *Seasons of Fruits useful to protect Cultivated Varieties.*

Common Name.	Scientific Name.	Native or introduced.	To protect —
Wild strawberry,	*Fragaria americana,*	Native	Strawberries,
Baked-apple berry,	*Rubus chamæmorus,*	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus canadensis,*	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus allegheniensis,*	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus triflorus,*	Native	Raspberries and blackberries,
Wild blackberry,	*Rubus frondosus,*	Native	Raspberries and blackberries,
Wild pepper,	*Daphne mezereum,*	Introduced	Raspberries and blackberries,
Red mulberry,	*Morus rubra,*	Native	Cherries,
White mulberry,	*Morus alba,*	Introduced	Cherries,
Juneberry,	*Amelanchier canadensis,*	Native	Cherries,
Wild red cherry,	*Prunus pennsylvanica,*	Native	Cherries,
Japanese cherry,	*Prunus japonica pendula,*	Introduced	Cherries,
Sargent cherry,[1]	*Prunus sargentii,*	Introduced	Cherries,
Mahaleb cherry,	*Prunus mahaleb,*	Introduced	Cherries,
Fly honeysuckle,	*Lonicera canadensis,*	Native	Cherries,
Fly honeysuckle,	*Lonicera cærulea,*	Native	Cherries,
Red-berried elder,	*Sambucus racemosa,*	Native	Cherries,
Asiatic service-tree,[1]	*Amelanchier asiatica,*	Introduced	Apples and pears,
Silky-leaved pear,[1]	*Pyrus elæagrifolia,*	Introduced	Apples and pears,
Flowering crab apple,	*Pyrus floribunda,*	Introduced	Apples and pears,
Dwarf crab apple,	*Pyrus toringo,*	Introduced	Apples and pears,
Hybrid crab apple,[1]	*Pyrus prunifolia,*	Introduced	Apples and pears,
Cockspur thorn,	*Cratægus crus-galli,*	Native	Apples and pears,
English thorn,	*Cratægus oxyacantha,*	Introduced	Apples and pears,
One-seeded thorn,	*Cratægus monogyna,*	Introduced	Apples and pears,



[1] Apparently procurable only from foreign dealers.

Other Means of Protecting Fruit.

Birds eat fruit not only for food but for the juices, which often serve to take the place of water in dry weather. A drinking fountain or a brook close at hand may serve to take some of their attention from the fruit. Newly turned sod also may attract robins and some other birds away from fruit, as they seem to prefer worms and grubs. A fertile, well-watered lawn sometimes answers the same purpose, as it keeps the earthworms near the surface where the robins can find them.

As a last resort, where one has but one or two cherry trees and no room for experiments, the trees may be covered with a fine-meshed fish net, but birds may become entangled in the net.

Plants for the Seashore.

Mr. McAtee in his excellent bulletin (621) gives the following hints regarding plants for attracting birds at the seaside: —

Where the coast is rocky and the soil of ordinary character, conditions are little different from those inland, and except in relation to exposure there need be no especial preference given in the choice of plants. It is worth mentioning, however, that several trees and shrubs are better adapted to withstand the winds so prevalent on the coast. These include three species of juniper (*Juniperus communis*, *J. horizontalis* and *J. virginiana*), common barberry, English thorn, hybrid crab apple, European and American mountain ashes, smooth and staghorn sumacs, privets, buckthorn and red-berried elder. Where the soil is chiefly sand, and that often shifting, conditions are not suited to many plants. Selection may be made, however, from the following, all of which are known to thrive in such surroundings: —

For Seed Eaters. — Beach grass (*Ammophila arenaria* and *Calamovilfa longifolia*), *Polygonum sachalinense* and sunflower.

For Fruit Eaters. — Bayberry (*Myrica carolinensis*), sea buckthorn (*Hippophaë rhamnoides*), sand cherry (*Prunus pumila* or *P. cuneata*), beach plum (*Prunus maritima*), cranberries and bearberry (*Arctostaphylos uva-ursi*).

Shelter Plants and Shelter Woods.

One great defect in parks and private estates is that there are few safeguarded thickets in which birds of the open can nest, and to which they can fly for protection from their winged

enemies. Closely clipped lawns and open fields with well-kept trees and flower beds seem to be about all that are included in the usual plan, and if shrubbery and vines are present, birds nesting in them are left undefended against the visitations of dogs, cats and other carnivorous or rapacious creatures.

In planting shrubs and vines to attract birds there are other purposes to be served than that of merely providing food. Thickets and hedges should be planted not only to feed birds, but also (1) to provide protection from their enemies, (2) shelter from storms, and (3) safe, convenient nesting places. All these purposes may be served by planting luxuriant shrubs and vines with thorny stems and dense foliage, together with dense coniferous trees. Plants of the genus *Cratægus* and those of other thorny genera should be grown in profusion, for in trimming such plants thorny branches may be provided by means of which the nesting place of birds may be protected from climbing enemies. Baron von Berlepsch of Thuringia, an authority on bird protection, plants in his estate at Seebach thickets and "shelter woods," which are surrounded by hedges of thorny plants. Hundreds of birds breed in his home park of only thirteen acres. He has selected by experiment for his shelter woods shrubs that will grow well in the shade, and both trees and shrubs that will stand close pruning. Such pruning tends to increase the number of branches and shoots, make the hedge denser, and provide safe nesting places. The plants used include the white thorn, *Cratægus oxyacantha* and *Cratægus monogyna;* hornbeam, *Carpinus betulus;* beech, *Fagus sylvatica;* dog rose, *Rosa canina;* wild gooseberry, *Ribes grossularia;* the American wild gooseberries and wild currants; several species of *Lonicera;* and for conifers, the red cedar, *Juniperus virginiana* and the Norway spruce, *Picea abies.*

The plantation may be of any size desired. The whole interior is planted with thorns three years old, from two and one-half to three feet apart each way, according to the fertility of the soil. Every twelfth plant, however, is a beech or hornbeam. Here and there a mountain ash or an oak are planted, and these are allowed to grow into tall trees. The whole plantation is surrounded by a hedge of dog roses. It is best to have at least three rows with plants two feet apart

each way. This plantation should be kept cultivated and weeded at first, and even watered, if necessary, and if rabbits are abundant it may be well to surround it at first with a fence of wire netting. Later a few pollarded firs or some Norway spruces, currants and gooseberries are planted, and once in three or four years, until nine years have elapsed, the woods and other bushes, except the outer hedge, are closely pruned in such a way as to make them send out a dense growth of many whorls which offer excellent nesting places for birds.

The entire plan of the plantation is fully described and illustrated in the English translation of a small volume entitled "How to Attract and Protect Wild Birds," by Martin Heismann, translated by Emma Buchheim, and sold at cost by the National Association of Audubon Societies, 1974 Broadway, New York City.

The currants and gooseberries should not be used in Massachusetts, as plants of the genus *Ribes* are hosts of the destructive pine blister-rust, which cannot propagate itself without them. In Massachusetts the Japanese barberry, *Berberis thunbergii*, might be used instead. It is a thorny plant, will bear pruning, has a dense foliage, and will grow to a large size. Experimental planting of such shelter woods should be tried in this country. There are many native plants and trees and some garden shrubs that might be used for these plantations. Some of them might be selected from the lists hereinbefore given. Those who have large estates and the means for unlimited planting may thus provide shelter for thrushes, catbirds, towhees, sparrows and bush-nesting warblers.

Every small home garden should have a wild hedge next the fence which should be allowed to grow into a veritable jungle. Mrs. Mabel Osgood Wright describes such a hedge in "Bird-Lore." [1] She recommends for the taller shrubs and trees to be placed next the fence, or for the backbone of the hedge early sweet cherries, flowering dogwood, staghorn sumac, mountain ash, Russian mulberry, sheepberry, wild black cherry, spicebush and shadbush or Juneberry. Next, elderberries, wild plums, flowering raspberry, barberries and currants.[2] For

[1] Bird-Lore, Vol. VII, No. 2, March–April, 1905, p. 149.

[2] Currants should be omitted, as hereinbefore stated, on account of the blister-rust.

vines she recommends small fruited varieties of wild grapes, that may be readily grown in pots from seeds and set out when six months old, Virginia creeper, waxwork, the yellow chinese honeysuckle and the bush honeysuckle. She would surround this hedge with a border of rich earth at least a foot wide, wherein to plant wild strawberries, and every six feet also a plant of the Lucretia dewberry. Then she would keep hands off and let nature take her course, letting the leaves lie where they fall. If strong canes of wild blackberries and thorny greenbrier are used to form a fence about the hedge, so much the better. Mrs. Wright also described, as follows, in "Bird-Lore" how she made a successful resort for thrashers in her garden, which they found, and in which they nested the second year.[1]

It was late autumn, the time when, the garden being put in order, there is a little breathing space for cutting old wood from the shrubberies, and shortening long shoots that are sure to be weighed down and broken by snow and wind. One rather shabby-looking group of shrubs had been selected for a special attack, a straggling flock of the prune-leaved spirea, with double white flowers like tiny roses ("Bridal-wreath" was, I think, the name given it in the old garden from which mine came). This spirea, by means of tap-roots, walks along, and, if the soil be good, sticks out its elbows and quickly appropriates the surrounding country. Every third year this particular tangle had to be thinned out and this was its third year. Before ordering wholesale slaughter, I drew near, to see what other plant wanderers had joined the gypsy band, and helped make an almost impenetrable thicket between the flower-corner and the house itself. Amid the sharp, straight shoots of spirea were raspberry canes, lilac suckers, several wands of sweetbrier, young tartarian honeysuckle, cornels, and black cherries — all telling that the thicket was a favorite perch for birds. Around this, stretched like long arms, long vines of wistaria were clasped, and when I tried to pull them away a sharp barberry thorn plucked me by the sleeve. As I stopped to free myself, something whispered in my ear: "Here is what you are looking for, a perfect Thrashery, all ready made and waiting. All you have to do is to protect this place near the ground from cats, for they will not be able to force themselves through higher up." Instead of cutting and pruning, I called the man-of-all-garden-work to help me build, and some lengths of fence netting with a barbed wire top and bottom were pushed between the bushes close to the ground and wired together, until a space of some twenty feet was enclosed. The meshes of the wire were sufficiently wide to admit a large bird, but nothing more.

[1] Bird-Lore, Vol. XV, No. 6, November-December, 1913, pp. 362, 363.

There are many native plants that may be utilized in the shelter and protection of birds. The greenbrier, *Smilax rotundifolia,* growing over shrubbery will help to form a thorny, almost impenetrable thicket. Native thorns of the genus *Cratægus* are quite as useful as the foreign species. There are garden shrubs also that may be utilized in thick clumps or hedges to make retreats for birds. The syringa bush is a favorite with catbirds and thrashers. The ornamental Forsythia is another favorite of the birds. *Caragana arborescens,* or any of the hardy species of varieties of *Caragana* are useful. The blossoms of these shrubs are said to attract hummingbirds. The spireas are dense. *Physocarpus opulifolius,* the ninebark, is easily grown in almost any soil. Some of the varieties of *Philadelphus* are excellent. *Lonicera tatarica* grows into a high, dense bush, bearing very ornamental flowers, and a fruit that is sought by birds. Shrubs, such as the common lilac and the spireas, are likely to throw off suckers from the roots, thus making their cover and defence still denser. The birds which frequent such thickets will leave there the seeds of blackberries and other plants the growth of which will add to the tangle. Honeysuckles and privets grow well in the shade. Most barberries, cherries, mulberries, sumacs, roses, viburnums and grapes also grow well on ground partially shaded. Dr. Eleanor Mellen, in a booklet published by the New England Nurseries Company of Bedford, Massachusetts,[1] gives lists of species and varieties for attracting birds, among them those that will grow among rocks and in thin soil, and those that will do well in moist soil.

The following list is adapted to our purpose: —

For planting among Rocks and in Thin Soil.

Celastrus (bittersweet).
- *Celastrus orbiculatus.*
- *Celastrus scandens.*

Gaylussacia baccata (black huckleberry).

Juniperus (juniper or cedar).
- *Juniperus communis.*
- *Juniperus virginiana.*

Lycium (boxthorn or matrimony vine).
- *Lycium halimifolium.*

---

[1] Mellen, Eleanor, Practical Methods of Attracting Wild Birds.

Myrica carolinensis (bayberry) and *Myrica cerifera.*
Parthenocissus (woodbine).
    Parthenocissus quinquefolia and varieties.
    Parthenocissus vitacea.
    Parthenocissus tricuspidata.
Rhus (sumac).
    Rhus glabra.
    Rhus typhina.
Rosa (rose).
    Rosa blanda.
    Rosa carolina.
    Rosa lucida.
    Rosa multiflora.
    Rosa nitida.
    Rosa rubiginosa.
    Rosa rubrifolia.
    Rosa rugosa.
    Rosa setigera.
    Rosa spinosissima.
    Rosa wichuraiana.
Vaccinum pennsylvanicum (low blueberry).

For planting in Moist Soil

Amelanchier botryapium (shadbush).)
Benzoin æstivale (spicebush).
Cephalanthus occidentalis (buttonbush).
Cornus (cornel or dogwood).
    Cornus alba.
    Cornus alternifolia.
    Cornus florida.
    Cornus racemosa.
    Cornus sanguinea.
    Cornus sericea.
    Cornus stolonifera.
Cratægus (hawthorn).
    Cratægus rotundifolia.
    Cratægus phænopyrum.
    Cratægus crus-galli (and other American species).
    Cratægus Oxyacantha.
Ilex (holly).
    Ilex opaca.
    Ilex verticillata and *I. lævigata.*
Nyssa sylvatica (sour gum or tupelo).
Rhamnus (buckthorn).
    Rhamnus cathertica.
    Rhamnus dahurica.
    Rhamnus frangula and others.

Sambucus (elder).
Sambucus canadensis.
Sambucus nigra.
Sambucus racemosa or pubens.
Vaccinium (high-bush blueberry).
Vaccinium corymbosum.

Among other devices for sheltering birds on the estate of Count von Berlepsch at Seebach is a broad hedge of fir trees about five hundred and forty-seven yards in length, growing beside a ditch. Such a ditch and hedge make an excellent fence as well as a bird shelter. The hedge is used to connect the shelter woods with one another and with the park. Here and there along the hedge on one side or the other are mountain ash trees and pollards (trees that have been lopped or cut back). The fir hedge, now about thirty-five years old, was planted in three rows with a space of three feet between the rows and the same space between the trees of each row. It was kept low by lopping off the tops. As the branches spread and interlocked, the center row was removed and every other tree taken out of the outer rows. All the branches were kept alive by this method. The tops of the trees are cut off every four or six years, and for this purpose the hedge is divided into six parts, so that in some parts the tops are always growing. While birds nest in the hedge, its great value lies in the shelter between the trees and beneath the wide-spreading branches, where birds and game find a safe retreat and feeding place in winter. The hedge when thirty years old was somewhat over twenty feet in width.

How to Plant.

Inexperienced planters are likely to fail even if provided with excellent plants or seeds. The common plan of sticking seeds into little holes in the sod or leaf mold is foredoomed to failure, as only a very small percentage of the seeds ever succeed. The resulting young plants are exposed to many enemies and must compete with grasses, weeds or other well-established plants which surround them. If seeds are to be used they should be planted in rows about nine inches apart, near the surface, in a box of good loam, where they can be watched,

weeded and cared for, or in a well-prepared bed surrounded with boards and covered with "cellar wire" netting to keep out mice, rabbits, squirrels and other enemies. If planted in the fall they should be mulched the first winter. When they have outgrown this little nursery they may be replanted in nursery rows or set in the ground where they are to remain.

Plants from the nurseryman, if well cared for and properly packed, should be moist about the roots when received. The bundles should be unpacked as soon as possible, the bunches loosened enough so that all the roots may come in contact with the earth that is to receive them and they should be "heeled in" or covered at once in a trench in moist earth on the north side of a building or in a cool cellar. A brief exposure to sun and wind is enough to destroy both root hairs and rootlets. If at all dry when received the roots should be immersed in water before heeling in. Plants thus treated may be left with safety while the ground is being prepared to receive them. Young trees arriving with the roots dried out will sometimes recover if the top be cut back severely and the entire tree immersed for a few days in moist earth before planting.

The worst possible way to set out a tree is to dig a little hole in old sod and set the tree in it.

The best way is to set all trees in land that has been well cultivated and manured for at least two or three years previous to the setting. Vigorous young trees from one to three feet high will make a better growth when transplanted than those that are older. There is no advantage for our purpose in bringing larger trees from the nursery. Trees may be started well in poor gravelly land by digging out a hole about two feet deep and large enough to hold a cartload of loam, in which the tree is set.

When setting out trees it is well to plow or trench the soil deeply and fine it well. I have had excellent success on poor soil by digging holes about eighteen inches deep and five feet in diameter and putting in with the loam some ground bone and chip dirt.

Before setting a tree its roots should be examined, and if any have been mangled or broken they should be trimmed back

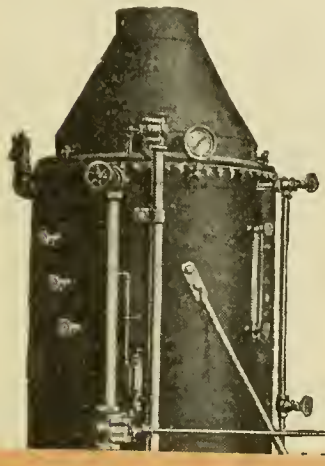
with a sharp knife. The top should be cut back in proportion to the injury to the roots. It is better, as a rule, to have the tree more nearly resemble a bean pole in shape than a tree when set out. The soil should not be wet nor dry at planting time, but moist and crumbly, so that it may be readily worked in among the roots. While planting, the roots should not be exposed to sun and air but should be kept covered in moist earth or with wet burlap until wanted. Some nurserymen before planting puddle the roots in mud made of rich, fine loam. The tree is then set in the hole prepared for it, the roots spread in their natural positions and the earth packed firmly among and around them. In this work both hands and feet should be used and no cavities among the roots should be left unfilled. It is important that the soil about the roots be very fine and well packed, and the surface should be left light, to prevent evaporation. In light soil the tree should be set a little deeper than in the nursery row, and it may be necessary to water it or to mulch it deeply the first year.

When large trees are to be transplanted it should be done by an expert, as the novice is likely to make an expensive failure. The directions given for planting trees may be observed to advantage in setting out vines and shrubs, modifying the operation to suit the various sizes and conditions. Any capable nurseryman should be able to furnish information regarding plants suitable for dry or wet soil or for planting in sunny or shady places.

Note. — The author will be glad to receive any information on any of the subjects treated in this paper. Address Edward Howe Forbush, 136 State House, Boston, Mass.

MEAD-M

LIFTS



Mead-Morr
Mead-Morr
time and r
No problem
utility and
the purchas
each piece
Mead-Morr
ence in de
country ha
material h
Our latest
Mead-Mor

Circular No 14

never printed

Contractors on wood stave pi
have found the FAVORITE
a real time-saver and a mone

Department Bulletin No. 15 March, 1921

The Commonwealth of Massachusetts

DEPARTMENT OF AGRICULTURE
Dr. ARTHUR W. GILBERT, Commissioner
136 STATE HOUSE, BOSTON

PRACTICAL SUGGESTIONS FOR RAISING TURKEYS

ERNEST EDWARD TYZZER
Professor of Comparative Pathology
and
MARSHAL FABYAN
Assistant Professor of Comparative Pathology
Harvard University Medical School

BOSTON
WRIGHT & POTTER PRINTING COMPANY, STATE PRINTERS
32 DERNE STREET
1921

Publication of this Document
approved by the
Supervisor of Administration.

Introduction.

The Department of Agriculture has the privilege of presenting in this bulletin what it believes to be an unusually valuable statement of practical results obtained in raising turkeys in Massachusetts. It is well known that in recent years the production of turkeys, not only in this but in almost all the other States where turkeys have been raised, has fallen off so that in most of these States turkey raising is, or soon will be, a lost industry. The facts stated in this bulletin indicate that the principal factors which have been preventing the successful raising of turkeys can be combated and that there is hope for a re-establishment of this important industry in many, if not in all, the localities where it has been abandoned.

The question of publishing the material presented in this bulletin was first taken up with the Poultry Department of the Massachusetts Agricultural College, and was referred by that department to this office. The kindness of the authors and of the trustees of the Massachusetts Society for Promoting Agriculture is hereby gratefully acknowledged, and makes possible the publication of this bulletin without expense to this Department other than the cost of printing.

A. W. GILBERT,
Commissioner.

PRACTICAL SUGGESTIONS FOR RAISING TURKEYS.

BY ERNEST EDWARD TYZZER, PROFESSOR OF COMPARATIVE PATHOLOGY, AND MARSHAL FABYAN, ASSISTANT PROFESSOR OF COMPARATIVE PATHOLOGY, HARVARD UNIVERSITY MEDICAL SCHOOL, BOSTON, MASSACHUSETTS.

As compared with other lines of poultry, turkey raising has lost ground, at least in many parts of the country. Here in New England, where turkeys were formerly raised very extensively, we hear the statement made over and over again by farmers and poultry raisers that they are through with turkeys. That the turkey has disappeared from many localities where it was formerly raised in large numbers is noted, therefore, with more or less apprehension. The common experience is to have a fine flock of growing turkeys sicken and die after some weeks of careful attention and bother. Frequently an entire flock is wiped out or only one or two somewhat damaged specimens are left. From year to year results vary from comparative success to utter failure on account of various unknown factors which may or may not be present from season to season, and a lack of real knowledge of the difficulties involved.

The study of the turkey and of the disease which appears to be the chief obstacle to turkey raising has established certain facts which, although published in scientific journals, have not become generally known to those interested in raising turkeys, and numerous inquiries since we have undertaken our investigations have emphasized this lack of knowledge. It is therefore with the view of pointing out those facts which may be of importance to those engaged in raising turkeys that we present a popular article on the subject.

The rapid growth of the turkey, together with the relatively small amount of grain required for its diet, makes it one of our most economical meat-producing animals, and the popularity of this meat at a time when young turkeys are approaching maturity will undoubtedly continue to insure a ready market. Furthermore, there is little expense in wintering stock, as it is only necessary to keep a sufficient number for breeding purposes.

One has only to attend a conference of turkey fanciers to witness the confused state of the present knowledge. Many pet theories are propounded, and numerous preventives and cures for any and all symptoms are advocated, but there is an obvious dearth of real information on the fundamental principles underlying the problem. This is not to be wondered at when it is appreciated that the most important difficulty in turkey raising results from a disease which in many respects is quite unlike any other known disease of man or animals. In fact, it has baffled scientific investigation for many years, and while it is now fairly well understood, there are still certain points which have yet to be satisfactorily explained. Notwithstanding the variety of views and conflicting opinions, there is general agreement that this very fatal disease, commonly known as blackhead, is a most important obstacle to turkey raising.

Undoubtedly this disease often exists without being recognized. Without careful observation there is nothing very distinctive in the symptoms of the infection, and although the appearance of the liver and certain portions of the gut are quite characteristic, there is often no time or inclination to open a dead turkey and examine the internal organs. Of course turkeys may die from other causes, especially when very young, but it is usually found that when they die under apparently good conditions blackhead is present. That this disease causes 90 per cent of the losses in growing turkeys is probably not an overestimation.

This being the case, we will first outline what is at present known of this disease, and then discuss those conditions which favor successful turkey raising.

Blackhead.

This name is not especially appropriate for the disease in question, but has been retained for want of a more satisfactory term. It was doubtless applied on account of the change in color from the normal red of the head in health to a bluish or dusky color which usually occurs in sickness. This, however, varies with the degree of pallor, so that no great reliance should be placed upon head color alone as evidence of disease. To

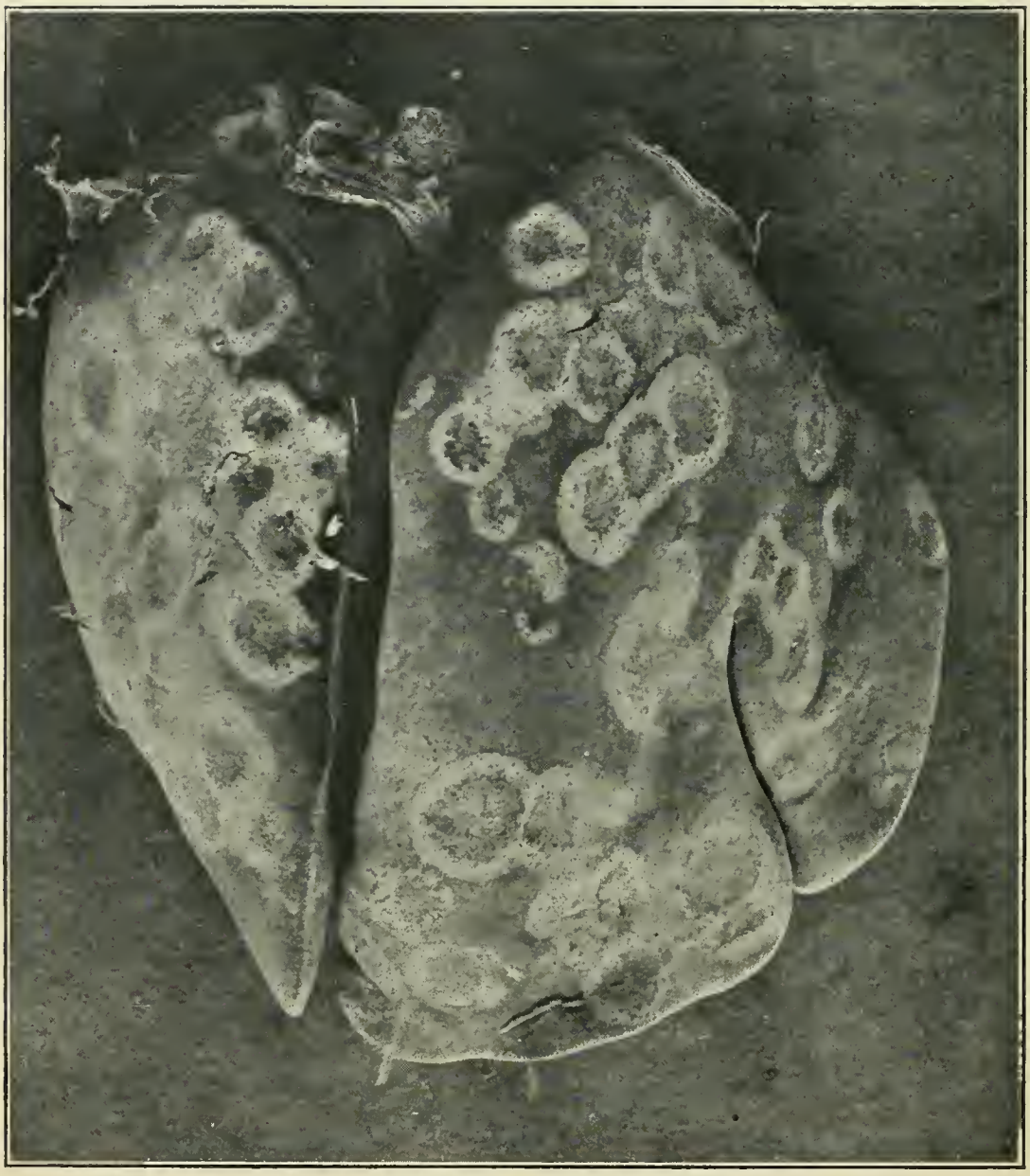


Fig. 1. — Liver of turkey, showing diseased spots characteristic of blackhead.

identify the condition positively as blackhead a dead turkey should be opened.

Organs diseased. — In examining the organs of a turkey which has died of blackhead the most prominent feature is usually the occurrence of gray or yellowish spots on the surface of the liver.

These are readily seen and measure from a very small fraction to three-fourths of an inch across. (See Fig. 1.) The disease does not start in the liver, however, but in a certain portion of the gut (intestine). If the course of the latter is followed throughout its length it will be found that in the lower portion two blind tubes are given off, one on each side, which extend along the intestine to which they are attached (see diagram, Fig. 2). These blind pouches, or cæca, as they are called, are of considerable size, being about a foot long in an 8 to 10 pound turkey. While they, like the human appendix, are prone to disease, nevertheless, they are doubtless of greater importance in the processes of digestion. It is in these cæca, towards their blind ends, that blackhead always starts, and an examination of these organs will always show in this disease a thickening of the wall, together with a change of color and opacity suggesting an abscess. Either one or both cæca may show disease affecting a spot, at times the size of a dime, or again, involving the greater portion of the wall. The cavity of the diseased cæcum is in some cases filled with a tough yellowish colored "core," or with soft, reddish gray, foul-smelling material.

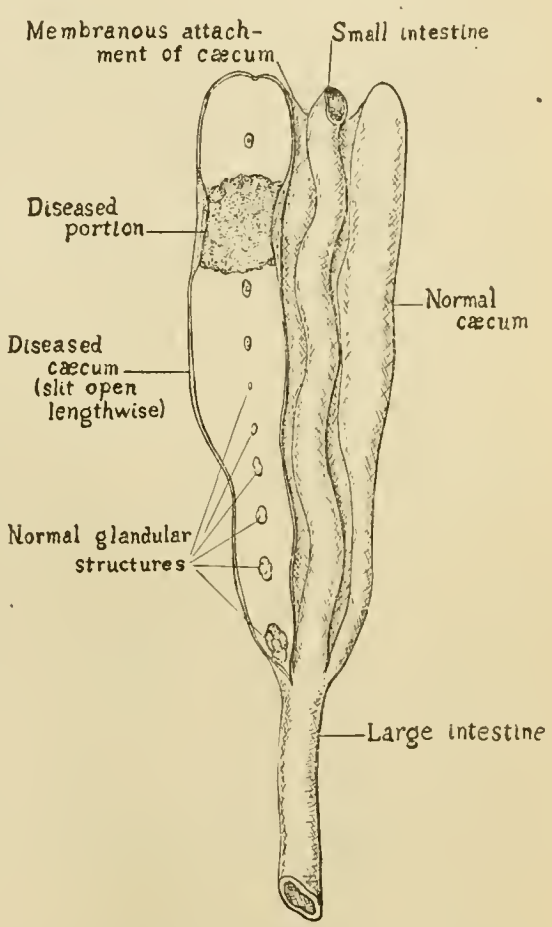


Fig. 2. — Diagramatic sketch, showing the two cæca attached throughout their length to the small intestine by a thin membrane. The cæcum on the left is represented as slit open to show its inner surface and a diseased spot; the cæcum on the right is normal and unopened.

The Disease-producing Germ associated with Blackhead. — The germ or parasite found in this disease is a low form of animal life, consisting of but a single cell and known as a protozoön. This was discovered by Dr. Theobald Smith in 1895, who named it *Amœba meleagridis.* Our studies have convinced us that it is not a true amœba but a protozoön of another type making necessary a change in the first or generic name so that it is now called *Histomonas meleagridis;* but this is unimportant in the present discussion. These parasites are somewhat rounded organisms varying in size but usually slightly larger than blood corpuscles. They occur in great numbers, and the diseased tissues are literally packed with them, like a honeycomb with young bees. That they multiply very rapidly is shown by the myriads produced in the relatively brief period of the disease. Apparently the parasite enters the turkey by way of the gut with the food or water, and under favorable conditions invades the wall of the cæcum and proceeds to multiply. Many of the organisms penetrate the veins of the cæcum and are then swept in the blood current to the liver. As the vein divides in the liver into numerous small branches or capillaries these organisms lodge here, as they are too large to pass through the smallest capillaries. They then begin to multiply, invade the liver tissue, and produce the spots already mentioned which are so characteristic of the disease.

We have been careful not to speak of this parasite as the cause of the disease, for although it is always found in the diseased tissue, the conditions which accomplish its introduction into the tissue are just as important from the standpoint of causing the spread of the disease as the parasite itself. Since it is always a portion of the gut that is first attacked, it has been generally assumed that this parasite is taken in with food or water. It might also be assumed that we should be able to produce the disease by feeding these germs to a young turkey, but this is not the case. We may repeatedly stuff young turkeys with large quantities of the diseased tissues containing myriads of the parasites without producing any disease. On the contrary, turkeys treated in this manner may grow somewhat faster than others, owing to the rich diet which they receive. Thinking that this germ might in most cases be destroyed by the digestive juice as it traverses the length of

the intestine, we have introduced it directly into the cavity of the cæcum. Here, again, no disease results. If, however, a small number of the parasites are introduced directly into the tissues themselves, blackhead invariably follows.

We thus have a very good acquaintance with the parasite in the tissue. Of its distribution in nature outside of the tissue practically nothing is known. Although resembling certain other organisms that live in the intestinal, or, more properly, the cæcal contents, and although it appears plausible to believe that it lives here as a harmless parasite, as suggested by Hadley, we cannot definitely demonstrate its presence. Whether it exists in any form free in soil or water, or whether it is confined to the turkey or other birds or animals, we have as yet no reliable information. Certain factors which bring about the invasion of the body by this parasite will be discussed presently.

Signs and Symptoms. — For the most part, there are no special signs or symptoms to show with certainty that a sick turkey is suffering from blackhead. There is a tendency to lag behind the flock. The bird walks with a slow, careful gait. Loss of appetite soon becomes apparent. The body weight suffers, as will be seen in curves shown in Fig. 3. Further manifestations of weakness appear. The back is hunched up both when walking or standing, and the turkey stands for long periods in one place with head under wing.

Fig. 3. — Curves illustrating normal growth of turkeys as contrasted with loss of weight in blackhead. Weight is plotted vertically against time horizontally. Turkey No. 16, whose growth is shown in the uppermost curve, grew rapidly until blackhead was contracted, when there was loss of weight followed by death. The lower curve (turkey No. 17) illustrates the constant increase in weight of a normal young turkey.

A suggestive sign of blackhead usually occurs after a few days in the appearance of opaque yellow or sulphur colored material in the droppings. No importance is to be attached to loose foamy or creamy droppings, varying in color from amber to greenish. These are often mistaken for evidence of diarrhœa, but represent material which is discharged normally at intervals, possibly once or twice a day, from the cæca, and appear quite different from more frequently passed, formed droppings from the intestine proper.

Incubation Period of the Disease. — From ten days to two weeks elapse from the actual invasion of the tissues by the parasite until the appearance of symptoms. Nothing is at present known of how long the parasite may live in the cæca without penetrating the tissues.

Course of the Disease. — Blackhead kills such a large proportion of turkeys which it attacks that any instance of recovery is questioned by some authorities. Such cases, however, do occur which show typical symptoms and later apparently return to normal health without any special treatment. On killing such birds one finds scars where healing has taken place in the cæcum and liver. It is also quite probable that mild unrecognized cases occur in birds that are approaching maturity.

Age of Birds attacked. — The opinion is frequently expressed that blackhead affects only young turkeys, and that after they have reached a certain age, popularly known as "throwing the red," they are quite safe. This is not true. While resistance to the infection evidently increases with age so that fewer birds are affected, and often in a less acute form, the disease may appear at any time during the growth of the turkey. We have noted blackhead in December, during the last three seasons, in turkeys which weighed from 5 to 12 pounds.

Death appears to be due to the involvement of a vital organ, usually the liver, to such an extent as to prevent it functioning. Apparently no definite poison is produced in this disease. The temperature of a considerable number of infected birds showed no fever or variation from the normal.

Transmission of Blackhead.

The opinion is sometimes expressed by turkey raisers that "the disease is not contagious," implying that it is not readily transmitted from sick to healthy turkeys. There is considerable evidence to support this view. Experimental attempts to produce blackhead by exposing healthy young turkeys to those suffering from blackhead rarely give positive results. The irregularity of the results of such experimental exposures suggests that the transmission of the disease depends on some other condition or conditions than on the mere transference of the parasite of blackhead to healthy birds. It has already been pointed out that young turkeys may be fed great quantities of this germ without producing the disease. This failure to contract the disease, however, is not due to any lack of susceptibility, for it is known that all turkeys, apparently without exception, develop the disease when the parasites are inoculated directly into the tissues.

An attempt has been made to lower the natural resistance by cold and wetting. A turkey chick was chilled by sitting in cool water a few minutes daily for several days, and at the same time was fed large amounts of diseased tissue containing living blackhead germs. The only difference shown in the subsequent development of this turkey was that he became the largest and smartest one of the lot in which he was hatched.

Intestinal Worms as a Factor in Transmission. — Experiments carried out quite recently by Graybill and Smith have resulted in a very interesting discovery. They found that by feeding young turkeys the eggs of a small worm which is commonly found in the cæca of both common fowls and turkeys, they always produce blackhead. This worm, called *Heterakis papillosa,* about one-half an inch in length, is very widespread, and is probably to be found in almost all flocks of fowls, and especially in yards where fowls have been kept for some time. The microscopic eggs of these worms are discharged in the droppings of fowls, but have to develop on the ground for from two to three weeks with a favorable amount of warmth and moisture before they are ready to hatch. When such "ripe" eggs are eaten by other fowls or turkeys they hatch out and the young worms grow to maturity in the cæca. These

worm eggs are evidently quite resistant. It is not known exactly how long they remain alive in soil or water, but they have been kept for several months in moist material without deteriorating.

This discovery raises several important questions: (1) Is the disease, following the ingestion of worm eggs, true blackhead? (2) Is the worm another host for this parasite, playing a rôle similar to that of the mosquito for the parasite of malaria in man? (3) Is the blackhead parasite present in all turkeys, lying in wait until some friendly worms come along to give it a start in life? The first of these questions is readily answered. The disease which appears in young turkeys following the ingestion of ripe worm eggs is true blackhead, for the diseased tissues always show the characteristic appearances and great numbers of the specific organism. Whether the worm serves as a host is not yet definitely determined, but it is difficult to see how a germ as large as the parasite of blackhead could be included in the eggs of the worm. The question of the distribution of the blackhead parasite in nature also requires further investigation. The results of the experimental feeding of worm eggs to turkeys indicate that either the blackhead parasite is very prevalent in healthy young turkeys, or that it is associated in some way with the worm in question.

The part played by worms in the production of blackhead may throw new light on the prevalence of blackhead in young turkeys which are allowed to run with old turkeys and common hens, or on ground that has been frequented by them. We have repeatedly produced blackhead by placing young turkeys, previously isolated, either with a flock of hens or on ground that had been worked over by them.

The question may be asked whether the development of worms in young turkeys is always associated with blackhead. While this disease has always followed the experimental feeding of a quantity of ripe worm eggs, we find in nature worms in greater or smaller numbers in the majority of turkeys. They may even become very numerous without having produced blackhead. Strange to say, we also find some cases of blackhead which show very few worms, and others in which no worms are found. It is difficult to explain these discrepancies.

It is possible that the introduction of a large number of

worm eggs on a single occasion, which rapidly produce a quantity of young worms, causes an injury which allows the blackhead parasite to penetrate the tissues. It is also possible that such conditions may occur in nature when young turkeys rather suddenly acquire a large number of parasitic worm eggs. On the other hand, the cases of natural blackhead associated with few or no worms suggest that there may be conditions, other than those resulting from the presence of worms, which favor blackhead. The point to be emphasized is that we know that the ingestion of an excess of worm eggs will probably produce blackhead.

Before continuing to the practical application of the established facts concerning blackhead to the problems of turkey raising, it may be well to summarize the results of investigations to date: —

1. The exposure of healthy young turkeys to those having blackhead does not regularly produce the disease in the former. It is possible that sick turkeys are no more of a menace than a flock of common fowls or old turkeys.

2. Practically all turkeys are susceptible to blackhead, as may be demonstrated by experimental inoculation.

3. The feeding of large numbers of the ripe eggs of the intestinal worm, *Heterakis papillosa,* is followed by blackhead.

4. Turkeys may acquire naturally a considerable number of worms without developing blackhead.

5. Under natural conditions, while blackhead is commonly associated with a large number of worms, cases sometimes occur in which there are few or no worms.

What is the practical bearing of these experimental findings? Everything points to one basic principle, and that is *isolation* for young turkeys. To what extent isolation will be effective with respect to the acquisition of the parasite of blackhead we do not not know, but this is certain, that isolation will be effective in keeping down the worm population in young turkeys. By isolation we do not mean nominal isolation with an old turkey or with an old hen, or isolation for a month and then allowing the brood to mingle with the other inhabitants of the farmyard. We do not deny that it is sometimes possible to "get by" with such makeshift isolation; in fact, probably the great majority of present-day turkeys are raised under just

such conditions. Elimination of losses, however, is going to be a big factor when it comes to reckoning the profits. The method of raising turkeys in the past has so frequently met with disaster that it is now time to look for an improvement of method if we are to continue to have turkey for Thanksgiving and Christmas. That turkeys may on occasion be raised with a turkey or common hen for a mother is quite true, and the usual remark that "It saves a lot of bother" is also true; but the point is not one of bother but results.

The question now arises whether the method of isolation which we propose will not yield greater profits, notwithstanding an extra initial cost for an incubator, brooders and fencing. That the reader may judge for himself (or herself), the following résumé is given of our experience in raising turkeys for experiments during the last three summers, and also of an experiment on a somewhat larger scale carried out on the estate of Mr. Richard M. Saltonstall, at Sherborn, Massachusetts.

Raising Turkeys at the Laboratory.

Summer of 1918.

Two lots of turkeys were hatched during this season from eggs incubated by hens. One hen was kept in each instance to mother the turkeys hatched.

Lot 1. — Seventeen turkeys hatched June 12 from twenty-four eggs. These were placed with the hen on grass between buildings of the Medical School. On September 6 and 7, when eighty-six days old, they were removed to a field where hens had wandered to a slight extent. Two were used for experimental purposes, and the fifteen remaining were sold on September 21. On October 8 two of the latter were brought back dead and showed blackhead. Whether they contracted this from the exposure to hens prior to their sale, or subsequently, is impossible to determine.

Lot 2. — From twenty-five eggs incubated under hens sixteen turkeys were hatched on July 14. Two of these were weaklings. Three were taken by a cat, leaving eleven for experimental purposes. When this lot was sixty days old two turkeys sick with blackhead were placed with them. Fifteen days later one sickened and later died of blackhead. The ten

remaining were subsequently fed diseased tissue from blackhead cases without result. On November 8 they were taken to the country where they roamed freely, occasionally visiting hen yards. On November 30 two of these turkeys became sick, and when killed showed characteristic blackhead.

From the above season's experience it may be concluded: (1) that it is sometimes possible to raise young turkeys with a common hen for mother; and (2) that exposure to hens and henneries may result in blackhead, even after the turkeys have grown to considerable size, — 7 and 8 pounds.

Summer of 1919.

Only one lot of turkeys were hatched during this season, and all were used for inoculation purposes. Eggs were incubated under common hens until the day before hatching, when they were transferred to an incubator. Instead of placing the newly hatched turkeys in the care of a hen they were placed in a brooder to which they adapted themselves as readily as young chickens. Nineteen normal young turkeys were hatched from twenty-four eggs. When about six weeks old two were suffocated from "crowding" in a poorly devised shelter during a cold night, and soon after this two were killed by a cat, leaving a flock of fifteen. Seven were inoculated when forty-eight days old, and the others were used at ages from two to three and a half months. One of the fifteen turkeys acquired blackhead naturally. This was attributed at the time to exposure to the seven inoculated birds, but, from what has since been learned, may possibly have been due to the acquisition of worms.

The only practical bearing of this year's experience was the demonstration of the ease with which young turkeys could be hatched in an incubator and reared with a brooder in place of a hen for a mother. The advantage of having a stock of turkeys absolutely free from lice and other vermin is obvious.

Summer of 1920.

The data obtained from turkeys raised during this season at the Medical School will be published in detail elsewhere. The turkeys were raised as described for the previous summer. A

considerable number of cases of blackhead appeared among the turkeys reared in the yard used for blackhead experiments during the two previous seasons, but none among those raised in a newly constructed yard. It is evident that the disease is less likely to appear in turkeys raised on new ground than in those kept on ground where hens or turkeys have previously been kept.

Field Experiment at the Saltonstall Farm.

This experiment was undertaken with the object of determining what measure of success would follow the maintenance of somewhat different conditions for different lots of turkeys. Mr. Saltonstall, in undertaking this co-operative work, furnished the stock, land, fencing, labor, and all other details, staking the success of the experiment on the efficacy of the procedures followed. The arrangements for the experiment were made by the superintendent of the farm, and it was through his interest and supervision that the conditions desired for the experiment were maintained throughout the season. Certain breaks in the original plan were unavoidable on account of the failure of employees strictly to follow directions.

We were informed that turkey raising had been attempted for several years, but never with much success. In the previous season one hundred young turkeys were hatched under Rhode Island Red hens, and kept in the yard with the old turkeys. Forty of these turkeys were reared. Of the sixty lost it was thought that about fifty died from blackhead and the rest from other causes. The turkeys lost began to die at six weeks of age, August being the worst month. After the period of "throwing the red," losses ceased. The various sick birds were doctored with various remedies, but not one recovered.

At the time that this work was undertaken, in 1920, two broods of about thirty young turkeys had already been hatched and placed in care of common hens. For the purpose of raising the greatest possible number of turkeys hatched, our advice was to have all subsequent hatchings take place in the incubator, and to have the turkeys brooder-reared, that they might be raised without contact with hens or old turkeys. Failure of the man in charge of the poultry to follow this plan

added to the interest of the experiment, but introduced an unnecessary risk. Thus young turkeys hatching from a batch of eggs incubated by an old turkey hen were left in her care. Other young turkeys were kept near the hennery and then placed with the brood, mothered by the old turkey. Furthermore, the man in attendance, having no great faith in new-fangled notions, and none whatever in professors, was less interested in the brooder turkeys, and some loss resulted from crowding and other causes. Examination of the organs of those dying showed no evidence of blackhead.

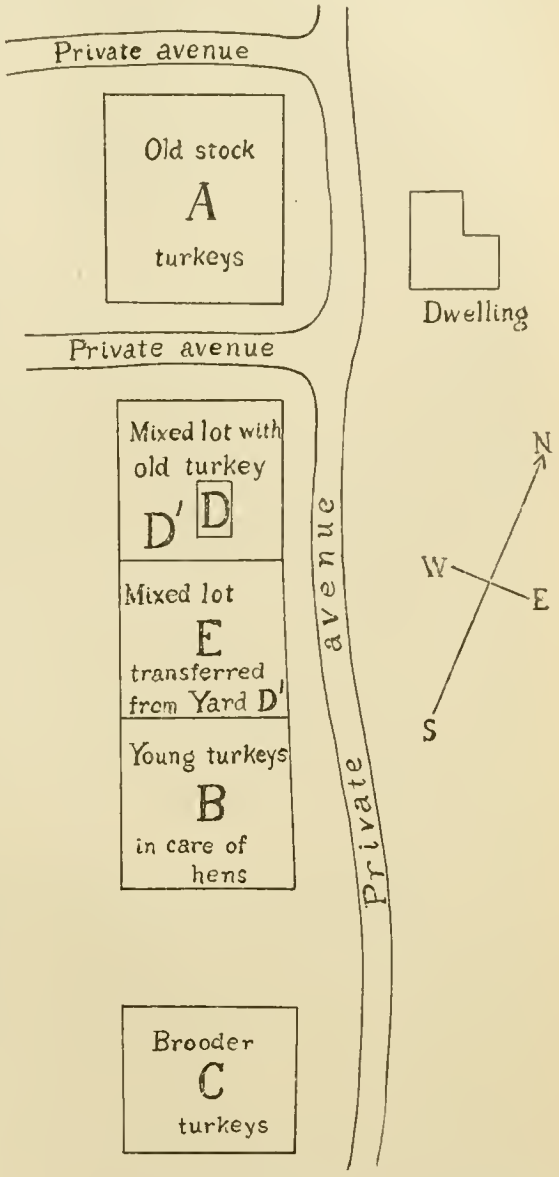


Fig. 4.—Plan of enclosures in which turkeys were raised on Mr. Saltonstall's farm at Sherborn, Massachusetts.

The yards for the various groups of turkeys were built on grassed-over sloping ground with more or less shade furnished by small white pines. The general arrangement of the yards is shown in the accompanying plan.

On May 15, at the time of our first visit to the farm, we found the old stock turkeys occupying an old enclosure designated as yard A. It was decided to fence in some new land on slightly higher ground to the south, making yards B and C, the former for the two lots of young turkeys already hatched and in the care of common hens, and the latter for future incubator and brooder raised turkeys which would be free from any contact with hens or older turkeys. These yards were about 85 feet square and cost

about $30 apiece. An intervening space was left between yard B and yard C. On June 1 young turkeys hatched by a turkey hen in yard A were placed with the old turkey in a small enclosure designated as D. Various additions were made to this lot so that it became necessary to furnish more space, which was provided by yard D′.

No case of blackhead occurred in either the brooder-raised turkeys (yard C), or in the hen-raised turkeys (yard B). Blackhead made its appearance in yard D′ shortly after the middle of September. Two turkeys died of the disease at this time. With the view of preventing further losses this lot of turkeys was moved to new ground, yard E. It appeared advisable to construct an additional fence so as to leave a space between yards E and B, but owing to the pressure of other farm work this could not be accomplished. Yard E was, however, divided into halves by a cross fence, so that the larger turkeys could be separated from the smaller ones that comprised the mixed lot that had occupied yard D′. There were then no further losses from blackhead in these yards. About two months later, after the turkeys had been moved to the hennery on account of the onset of winter, blackhead again appeared.

The conditions of the experiment thus resulted in the rearing of one hundred and twenty-three high-grade turkeys. The loss from blackhead was so slight as to be almost negligible, and it should be noted that the only cases occurring on the newly enclosed areas were in the hodgepodge group that had been exposed, to some extent, to hennery conditions as well as to an old hen turkey. Those brooded by old hens also "got by" without blackhead as well as the brooder turkeys. Two cases developed in cold weather after the young turkeys had been moved to hen houses.

What may be regarded as our "good luck" by some may be attributed to a favorable season by others. To refute the latter possibility it is only necessary to point to other farms in the vicinity where blackhead was very prevalent in young turkeys this same season. It appears to us, therefore, that, until other preventive measures for blackhead are found, isolation is practically essential to the successful rearing of turkeys.

While it may sometimes be possible to raise young turkeys with a turkey or hen, or in common with the other poultry, the losses attending these practices have often been so disastrous that turkey raising is no longer attempted in many localities which formerly produced large numbers.

It should not be supposed that isolation alone will insure success. Small turkeys, like children, require intelligent care, and probably this is one of the reasons why women have succeeded to a degree in turkey raising. Turkeys grow rapidly, so that they must be considered as babies until they are quite large. Those who are fond of animals succeed best in raising turkeys. Young turkeys that are ordinarily perfectly tame and tractable, if placed in the care of certain individuals become wild game birds, which become frantic with fear, and flutter about or hide on the approach of a human being. On the whole, however, their requirements are quite simple if only understood.

Various interesting beliefs have long existed concerning the details of turkey raising. In 1674 one John Josselyn, Gent, visited New England and gave the following account of the turkey: —

> The turkie, which is in New-England a very large Bird, they breed twice or thrice in a year, if you would preserve the young chickens alive, you must give them no water, for if they come to have their fill of water they will drop away strangely, and you will never be able to rear any of them: they are excellent meat, especially a Turkie-Capon beyond that, for which eight shillings was given, their eggs are very wholesome and restore decayed nature exceedingly. But the French say they breed the Leprosie: the Indesses make coats of Turkie-feathers woven for their children.

At the present time some turkey raisers will not let young turkeys out to range until the dew has dried off the grass. Wetting young turkeys is universally considered bad, but we have, nevertheless, succeeded in raising turkeys in a yard so poorly drained that it practically becomes a duck pond with each rainstorm. It is possible that there is something about moisture that favors the ingestion of worm eggs from the soil, — it is not improbable that the bird in loosening mud from its feet with its beak may get worm eggs — but in so far as

we can determine no amount of wetting will of itself produce blackhead.

Others lay great stress on warmth, and keep their turkeys in the kitchen nights until they are of considerable size. Warmth should be furnished sufficient to keep turkeys contented until they show an inclination to roost at night. The amount of artificial heat necessary will depend upon climatic conditions. By the middle of June, hereabouts, turkeys may be removed from the heated brooder to a hover when two and one-half weeks old, and subsequently even earlier.

Turkeys are said to die from eating ants, but ants are not necessary. They will die of blackhead where there are no ants.

"Sting nettle" is said to be a preventive of blackhead, yet this disease occurs in places where it abounds.

Some put great faith in various drugs and profess cures even for such diseases as blackhead. All attempts in the laboratory to influence this disease by using drugs of recognized value in the treatment of similar diseases of man and animals have failed entirely. It is possible that the administration of castor oil may at times tend to cause the loosening and discharge of the "core" from the diseased cæcum. This, however, will not affect the lesions of the liver, which are, after all, of primary importance. Recovery occurs without treatment in a small proportion of cases, and it is questionable whether any treatment, beyond placing the turkey where it is quiet and has access to clean food and water, causes any favorable effect. Whether the occasional administration of an effective vermifuge will serve as a preventive measure remains to be demonstrated.

Turkeys are supposed to require a wide range, but they develop perfectly well if kept in a cage 8 by 4 by 2 feet until they weigh several pounds. This should be placed on grass and moved at least once each day to furnish new forage. In fact, there are advantages in this method of confining young turkeys, in that their movements are controlled, and they do not have opportunity to wander to the hen yard or into other trouble. They are also safe from cats, foxes, etc., in these cages. If turkeys are kept confined in cages or small yards, their diet will lack the proteid that they would obtain in the wild state, and this may be supplied in the form of sour skim milk. The

entire skim milk must be fed from the start, and this is taken better if soured. Turkeys fed the curd when small will later refuse both the whey or the whole milk, and a great proportion of curd-fed turkeys show faulty bone development, often so marked as to make standing and walking impossible.

The conditions favoring the development of blackhead are found on almost every farm, and unless provision is made to remedy these conditions turkey raising must be considered a most unpromising proposition. The question now arises as to whether there will be any profit in turkey raising with the expense of maintaining young turkeys in isolation from other poultry. This will depend, to a large extent, upon location, and whether one can spare time and attention from other occupation.

Practical Suggestions.

The fundamental points in turkey raising may be briefly outlined as follows: —

1. Hatching free from contact with old turkeys and common hens.
2. Proper diet to insure rapid growth.
3. Proper housing and restraint.
4. Protection from intestinal worms.
5. Protection from animals and birds of prey.

Hatching and Brooder-raised. — Fertile eggs should be incubated, or set under a hen until twenty-four or forty-eight hours before hatching, when they should be transferred to a clean and properly running incubator. After the turkeys are twenty-four to thirty-six hours old they should be placed in a brooder which must also be clean and properly heated. This insures the young turkeys a start in life comparatively free from various parasites, such as lice and intestinal worms, which in the early weeks they seem less well prepared to accommodate than as adults.

Diet. — Young turkeys are finicky about their food, and it is rather difficult to get them to accept food with which they are not already familiar. For this reason it is important to supply from the very first the articles of food which are to comprise their subsequent diet. On removal from the incubator they are given a sip or so of clean water and placed beneath the

hover of the brooder. A small amount of finely crumbled boiled egg is given from twenty-four to forty-eight hours after hatching, and three times a day thereafter for at least a week. The floor of the brooder should be covered with a few handfuls of clean hayseed or similar material, uncontaminated by poultry. After the second day a supply of clean water and a small dish of sour milk should always be available. If the weather is mild and sunny the young turkeys may be let out of the brooder onto clean grass, which they will soon learn to eat. A sprinkle of fine chick feed should be given along with the crumbled egg, since grain will later on form a part of the diet. An ample supply of fine grit should always be available.

After the turkeys are a month or six weeks old, mixed grain should be added to the chick feed, and after the turkeys are found to take this it may replace the latter altogether. Only as much grain as will be cleaned up at each feeding should be supplied. This is important, as it lessens the chances of infection from unclean food. Coarse grit should be supplied as the turkeys get older. If green forage runs low, it may be supplemented by lettuce or cabbage. These should be hung on a nail, for turkeys do not accept loose green material until quite large, but prefer to tear off pieces.

The diet of the growing turkey thus consists of sour milk, mixed grain, green forage, water, grit, and what insects it is able to catch.

Housing. — Young turkeys must be provided with clean surroundings. The incubator must be thoroughly cleaned before each hatching, and the brooder, if it has been used before, should be preferably painted over, or at least whitewashed thoroughly inside. The hover, if not new, should be thoroughly washed with soap and water and provided with clean flannel. It is well to so arrange the hatches as to have an interval in which the brooder may be thoroughly cleaned. It has been our experience that it is bad practice to mingle successive small batches of turkeys in a brooder. The dosage of certain intestinal parasites, which are apparently always present, and which are practically harmless if acquired gradually, is so great that very young turkeys are likely either to succumb or to have their growth somewhat checked.

The brooder should be provided with a cage of chicken wire having a top with a door for feeding, but no bottom. We have used a cage 8 feet long, 4 feet wide, and 2 feet high. At one end is an opening to correspond with the door of the brooder. Such a cage will be ample for twenty to twenty-five young turkeys until they are two and one-half to three weeks old, when they may be moved from the brooder and provided with a hover without artificial heat. Their housing from now on may be varied according to the number to be raised and the surrounding conditions.

A small flock of turkeys, one to two dozen, may be raised in cages, as described above. They are then safe from hawks, cats, etc., and there is no danger of their getting out of bounds or into the hen yard. A dry goods box, with a hole in one end and with a movable top covered with roofing, is provided as a shelter in each cage. Within each box should be placed a hover with strips of flannel for warmth. In case a hover is not provided the young turkeys may suffer from cold at times, and their crowding into a corner may cause losses from suffocation. While a single cage and hover will take care of a dozen turkeys for a time, it will later be necessary to separate them into lots of not more than six to a cage. The cages should be shifted a foot or two daily to furnish new forage, and a piece of roofing across the cage top furnishes both shade and protection from rain. We have raised turkeys in such cages up to 6 or 7 pounds' weight.

In case there is no poultry near, the young turkeys may be let out of the cages to range after they are of a size to take care of themselves. They should always be brought back to their cage for feeding, and shut in at night. In fact, ranging for a few hours each day will be sufficient for their needs. Later on they may be allowed to roost in trees or elsewhere.

The tendency of turkeys to wander makes it imperative to have some sort of an enclosure for them after they become too large for their cages. If their pasture is divided into two or more yards, the birds may be kept in one yard while the forage is growing in another. They should always be shut into a cat-proof shelter at night. A fairly good plan is to have doors open from this shelter into the various yards. It will be a

distinct advantage to have as many yards as possible so as to furnish fresh forage, for birds roaming over their entire pasturage soon trample it to such an extent that it becomes unattractive for them. In case the number of yards is limited, a portable strip of fence confining the turkeys to a portion of the yard at a time is very effective. It is very important for turkeys to have ample pasturage during their period of active growth, as they consume great amounts of green stuff. The accompanying diagrams may furnish suggestions for the planning of the yards and night enclosure.

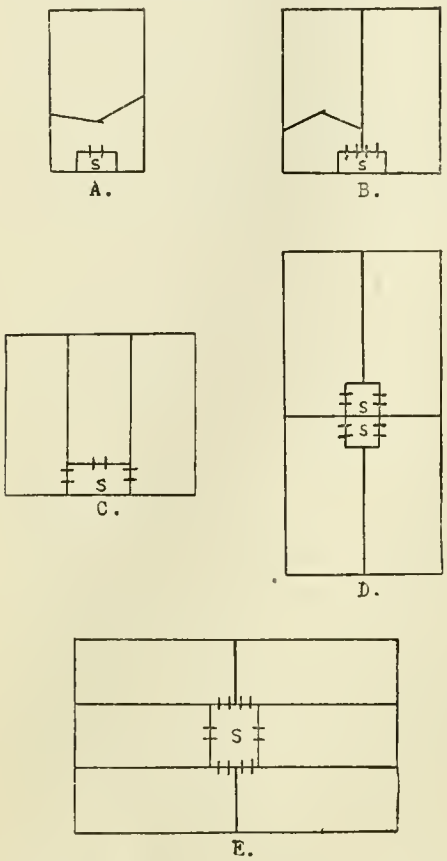


Fig. 5.—*Plans for Turkey Yards*—S, night shelter, from which gates connect with yards. A, single yard, provided with movable partition. B, double yard, with single shelter; a movable partition prevents the pasturage from being spoiled by trampling. C, three yards, into each of which the shelter opens. D, four yards, which may be provided with either one or two shelters. E, six yards, built around the night shelter, which may be subdivided if desired.

The shelter should be provided with a roof for protection from rain and for shade. It should also be provided with a box and straw for small-sized turkeys, and roosts for larger ones. Lots hatched at long intervals from one another will do better if kept apart. There will be no trouble with birds flying over fences if they are shut in every night after feeding, and otherwise kept contented. Turkeys have quite different feeding habits from chickens. Instead of being continually busy about something or other, their feeding times are alternated with long periods of rest, and young turkeys raised in the brooder probably do much better than those that are continually stirred up by the clucking of an old hen.

If turkeys are raised in such enclosures, where their movements are completely controlled, it will be found that their care is no more exacting than the care of chickens. As long as

they are kept isolated there should be no loss from blackhead. In case the disease appears, it should be assumed that they are getting worm eggs from the soil upon which they are confined, and steps should be taken immediately to move the yard to new land. With regard to the isolation of sick turkeys from the rest of the flock, this is proper as far as it goes, but it should be borne in mind that other sources of worm eggs are fully as important.

Protection from Intestinal Worms and Other Parasites. — The sudden acquisition of large numbers of the parasitic worm, *Heterakis papillosa,* commonly found in common fowls and turkeys, is extremely likely to be followed by blackhead. How, then, is this to be avoided? The giving of vermifuges from time to time will not insure against the acquisition of worms in the interval, for the eggs of the latter may be picked up at almost any time. It is necessary, therefore, to depend upon isolation. If turkeys are raised upon a place where no other poultry has been kept, isolation is a simple problem. It is then only necessary to keep the young turkeys entirely apart from the old ones, and never allow them on ground ranged over by the latter. In case poultry is kept upon the premises the problem is much more difficult, especially if it is allowed free range. It will then be necessary to keep the growing turkeys yarded on clean ground at a distance from the poultry. This makes their supervision more difficult, and the expense of fencing an enclosure large enough to provide forage throughout the season is likely to be considerable. Such isolation will probably not serve to prevent turkeys getting an occasional worm, but they are apparently able to take care of a small number of these without getting blackhead. The eggs of these worms are quite resistant, and are probably transported from place to place by sparrows and other birds visiting hen yards, and possibly, to some extent, by the flies that feed upon the droppings. If hens are kept, care must be taken that the droppings of the henyard are not carried into the turkey enclosure on the shoes of the attendant. The rule of always tending the turkeys first, and then the hens, is important.

Young turkeys should be kept away from other poultry until they are ready for market. Although few large turkeys suc-

cumb to blackhead, that loss is well worth preventing. The cæca and liver may show evidence of disease within ten days after exposure, and within a fortnight the loss of weight and obvious diseased condition may make the bird unfit for marketing.

For those who propose to undertake turkey raising on clean ground it is suggested that parasitic worms be eliminated from all poultry as far as possible. One may begin with turkeys or hens that have been placed in quarantine until they have received a thorough treatment with an efficient vermifuge, such as santonin or areca nut. The latter should be bought as whole nuts and freshly ground before using. This may be done with an ordinary nutmeg grater or coffee mill. An amount equal to 15 to 45 grains to a bird is added to the first feeding in the morning. This is followed an hour later by a dry mash containing Epsom salts (1 pound per 100 birds). During this period all poultry droppings should be collected and removed from the premises. Such stock should be treated at intervals of a week as a matter of routine. It is quite probable that the increased vigor of the stock would pay for this extra effort in addition to lessening the prevalence of blackhead.

Personal supervision is the price of success.

Acknowledgment is hereby made to the trustees of the Massachusetts Society for Promoting Agriculture for a grant to carry on investigations in this subject.

The Commonwealth of Massachusetts
DEPARTMENT OF AGRICULTURE
ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 16
June, 1920

TAKING THE RISKS OUT OF FARMING

E. S. BRIGHAM

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

TAKING THE RISKS OUT OF FARMING.

E. S. BRIGHAM, COMMISSIONER OF AGRICULTURE, MONTPELIER, VERMONT.

Those whose knowledge is largely confined to the purchase of food in the city market think of farming as one of the most independent and secure of occupations. The expression, "The farmer is sure of his living, anyway," is often heard and is commonly believed. It is very easy to account for this. When land enough for a farm could be had from a generous government for the asking, and when farming consisted principally in raising supplies for family use, it was true that the farmer had little to worry about.

Donald Grant Mitchell, in his book, "My Farm of Edgewood," written in 1863, refers to this type of farming thus: —

> The farmer, . . . inheriting his little patch of land, and feeling reasonably sure of his corn and bacon, and having none of that incentive which attends risk, yields himself to a stolid indifference. . . . Yet some of the agricultural papers tell us with pride that bankruptcies among farmers are rare. Pray why should they not be rare? The man who never mounts a ladder will most surely never have a fall from one. Dash, enterprise, spirit, wakefulness have their hazards, and always will; but if a man sleep, the worst that can befall him is only a bad dream.

This type of farming is passing as farm lands increase in price, involving heavy interest charges, and as farmers feel the need for money to pay for improvements, for automobiles, telephones, electric lights, etc., — things which are considered necessities to-day. Now the majority of farmers are doing a commercial business which does not differ essentially from the business of the manufacturer. Costs are incurred in raising a crop, for labor, machinery, fertilizers, etc., which must be paid with the proceeds therefrom, and a profit must be earned if the business is a good one. The farmer has all the risks of the manufacturer, and some besides, for while the manufacturer gathers his business inside a plant where he is independent of weather or the seasons, the farmer has to deal daily with weather

conditions over which he has no control and upon which he is dependent.

The commercial farmer, like the business man or the manufacturer, has two choices as to how he will conduct his business. He may plunge and take a gambler's chance upon the outcome of a single season's crops, or he may take a more conservative course, investing his capital partially in the extension of his enterprise, and partially in taking those precautions which will eliminate risks. In the fall, after a good season, it is quite common to read in our daily newspapers an account something like this: —

Mr. A makes Fortune in Squashes.

Mr. A of.....raised 20 acres of squashes this year which yielded a big crop and gave him a net profit of $200 per acre. Mr. A is employed in the.....Works, and hired this piece of land and took care of the crop before and after hours, with some outlay for hired team work. This shows what farmers could do if they were progressive.

Now the fact is that Mr. A simply took a flyer in squashes, and happened to hit a season when this vegetable grew pretty well in his particular locality, and sold in the market for a good price. Perhaps Mr. A might try again for several years and fail because of poor seasons or low prices. This is a type of farming which the farmer who is in business to make a living had, in my opinion, better avoid. It has been my own policy to study carefully how to eliminate risks in every possible way, so that the speculative feature would be reduced to a minimum, depending upon a steady gain ahead every year rather than heavy gains now and then and the possibilities of large losses.

The Farmer's Problem.

In considering this question of taking the risks out of farming, let us think first of all of what is involved in the problem. The farmer's business consists essentially in manufacturing crops from the soil. The live-stock farmer goes farther and carries on a secondary manufacturing process, but the first stage is the same for both. The leading factors involved are land, fertilizers, seeds, machinery, labor and markets. The farmer must so make use of these factors that he can produce

a good crop and market it at a profit. There are certain seasons when little skill is required to accomplish this task. The temperature is favorable, rain falls at the right time and in the right amount, and market prices are good. These seasons, however, are the exception and not the rule. We find that in the average season nature gives her support somewhat grudgingly; she withholds a little in one direction and a great deal in another. It is then that all the resourcefulness of the farmer must be brought into play, and it is against such contingencies that he must prepare if he expects to raise a crop in the adverse years and eliminate the risks from his business. With this end in view let us deal with some of the factors above enumerated.

Management of the Land.

Management of the land is the factor of first importance. This includes not only tillage, but the more complex problems of moisture and plant food control as well.

Moisture in the right amount is an absolute essential in the production of crops. There are probably few soils so poor that a crop cannot be produced if the right amount of moisture is supplied, and there are none so good that a crop can be produced without moisture. Most of our plants need for root room a zone $2\frac{1}{2}$ to 3 feet deep from which water should be quickly drained away. The farmer may well study his land to determine if he needs to assist the natural drainage processes by putting in a system of tile drainage. The answer is not hard to find. If work in the spring must often be delayed waiting for the land to dry off, and if cultivation must be delayed a long time after a heavy rain, — if, in fact, a crop is frequently lost or made unprofitable because of too much water in the soil, — then the risk should be eliminated by a system of tile drainage. In the case of most of the land on my own farm, a system of tile drainage is the determining factor in producing a paying crop in a wet year. Such a system, in pre-war days, cost about $50 per acre, and would cost $100 to-day. In no year have I failed to receive 6 per cent return on my investment, and in wet years, in growing expensive crops, I have received 100 per cent return. The value of the crop one is growing would, of course, be a consideration

in determining whether or not a tile system should be installed under given conditions. In the truck-growing sections of Norfolk, Virginia, I have seen complete systems of tile installed in sandy soil which one would expect to afford a very quick run off of rain water; but rains in that section are very heavy, and the crops grown are worth a lot of money per acre, so that the prudent farmer finds it a good investment to protect his crop by an expensive system of tile.

Quite the reverse is the problem of guarding against a dry season. Here, again, in the case of expensive crops, such as you market gardeners are growing, an irrigation system will undoubtedly pay. I have not come to that yet, but have depended upon careful conservation of moisture by cultivation to eliminate risks in this particular. Investigations made by King show that a clay loam soil which was not cultivated to make a dust mulch evaporated in one hundred days 2,414 tons of water, equalling a rainfall of 21.31 inches; while the same type of soil stirred to the depth of 2 inches to maintain a mulch evaporated but 979.7 tons, equalling a rainfall of 8.65 inches. The maintenance of a mulch, therefore, saved moisture equivalent to 12.66 inches of rainfall. Since a crop transpires 300 pounds of water for each pound of dry matter produced, the saving effected by the maintenance of a mulch might easily be the determining factor in a dry year in producing a crop, the moisture saved in the case of this type of soil being sufficient to produce $4\frac{3}{4}$ tons of dry matter. I have been most careful to guard against dry seasons by beginning harrowing of all plowed fields as soon as they were dry enough in the spring, harrowing again after each heavy rain until the crop was planted, and continuing to maintain a mulch by cultivating thereafter. This method will solve the weed problem, and will pay in insurance against drought big returns on the cost. The effects of a dry season may also be guarded against by increasing the humus content of the soil by plowing in green crops or manuring with stable manure. This is well illustrated by the results of long-range experiments conducted at Rothamsted, England. Grain was grown for years upon plots fertilized in different ways. In the cold wet season of 1879 the plot which had been fertilized continuously with a complete artificial fertilizer yielded

slightly more than did the plot which had received manure continuously; but in the extremely dry season of 1893 the manured plot yielded 14 bushels per acre more grain than did the plot receiving artificial fertilizer. I do not make as much money out of dairying as I do in growing truck crops, but I keep cows partly because I like them and partly because I believe I must have the manure to enable me to grow the crops successfully one year with another. I have tried to increase the humus content of my soil by plowing in winter rye, but the result was so disastrous one dry season that I abandoned the practice. It was my custom to sow winter rye ahead of the potato digger, depending upon the working of the soil by the digger to cover the rye. By June 1 of the next year there would be a heavy growth of rye to plow under when it was time to plant string beans. The season of 1911 was extremely dry, no rain falling after May. The rye made a dense growth, but in doing so exhausted the soil moisture, leaving but a small amount in reserve for the bean crop. A strip through the center of the field which had no rye gave us a fair crop of beans; the balance was a complete failure. I have never tried to get humus that way since, but have used rape and barley sown in late summer with good success. These serve as a cover crop, add some humus and do not interfere with the next crop.

Another important factor in land management is provision of an ample supply of plant food. Professor Van Slyke, in his introduction to his book on fertilizers, compares the condition of many American farmers to the experience related by Dr. Holmes, in "The Professor at the Breakfast Table," of the person who put a little money into a bank and drew checks against it. All went well for a time. The check book seemed a "dictionary of possibilities" in which could be found all the "synonyms of happiness;" at last, however, a check came back with these two words on it: "No funds." Seasons of abundant moisture and favorable temperatures for making available the plant food of our soil may delay its protest of our demands made upon it, but unless we provide a reserve of readily available plant food we shall regret it sooner or later. I believe that a farmer should have a savings bank account to

guard against a financial emergency; but I believe also that the farmer who does not make a little deposit of excess fertility in his soil each year, upon which he may draw when the cropping emergency comes, is not in the way of making the greatest possible success as a farmer. I have known farmers to whom it was a sort of a religion to deal justly with their soil — to make it better each year. These men seldom fail to produce a crop.

Good Seed.

The farmer who is looking to eliminate risks will pay most careful attention to his seed supply. The seed carries in embryo the possibilities of reproducing the parent plant. It may or may not have great productive capacity and great vitality which will enable it to survive adverse conditions; and it may be free from diseases which will jeopardize the crop, or it may be a carrier of these diseases.

In 1863 it took 18 pounds of beets to make a pound of sugar; in 1904 less than 7 pounds of beets yielded a pound of sugar. This improvement was brought about by testing the sugar content of individual beets and saving for seed production those which produced the most.

An experiment station has conducted a seven-year test of the difference in productivity of small and large plump grain seed. The results show an average increase of 15.4 bushels of oats, 7.8 bushels of barley, 5 bushels of wheat, and 5.1 bushels of peas from the large seed over the small.

I have seen no better illustration of the value of good seed than the account, in the "New England Homestead" of January 17, of the demonstration experiments conducted by the Hampden county agent on 11 farms to test the value of northern-grown certified seed potatoes in comparison with home-grown seed. The northern certified seed averaged 274 bushels per acre, while the home-grown seed averaged but 131 bushels per acre, or 143 bushels less. In a year of low prices this difference in yield produced by good seed alone would have made the difference between success and failure in the potato crop of this section. No work which our experiment stations have done for us has been more valuable than the breeding of good strains of seeds and the determination of their productivity.

Machinery.

I sometimes think we do not often realize how much we are indebted to machinery for our present industrial and agricultural output. Harrington Emerson, in his work on the "Twelve Principles of Efficiency," estimates that the amount of coal used to-day for power purposes develops a volume of power equivalent to supplementing each adult man with 22 mechanical slaves. The American farmer has always led the world in supplementing his own labor with horses and machinery, just as in this period he leads the world in the use of tractors. Prior to the war Germany had an agricultural population nearly as great as our own, but she had on her farms only about one fifth the number of horses and mules. Our superiority in horse power on farms over that of Germany would exert a muscular force equal to that of 80,000,000 men. Furthermore, it has been estimated that the farm machinery invented and perfected between 1830 and 1895 resulted in the latter year in saving 450,368,992 days' work, or 79 per cent of the labor which would have been required by hand methods to produce nine of our principal agricultural crops. The farmer, then, who would take the risks out of farming must pay careful attention to his farm power and his equipment of machinery.

We should consider carefully how much power we need, and whether it should be horse or tractor power, or both. There seems to be a pretty general agreement that tractor power is not much cheaper than horse power, but that there is a decided gain in time. This is a very important point in this climate where we have to raise crops between frosts. The first season after I bought my tractor was very cold and wet in the early spring. Our first plantings of string beans rotted and had to be replanted. This upset our schedules of plantings, and had there been much delay in replanting we would have run into fall frosts. But with the tractor working sixteen hours a day when dry weather came we were able to refit the ground for replanting quickly, to keep up with our other work, and grow a profitable crop. Our ability to meet this particular emergency probably paid the entire cost of our tractor. So far, however, I have not dared to let the tractor displace much

horse power. A tractor, even in good hands, has off days, when it is laid up for repairs. In the case of truck crops such delays are attended with too much risk. I have, therefore, kept the same number of horses as before I had the tractor, but have enlarged my business by purchasing another farm which is devoted largely to hay and grain growing. A few days' delay in handling these crops is not dangerous, so we have plenty of reserve power to handle our truck crops in an emergency, and use the reserve to advantage when all goes well.

I have found it good policy, also, to have duplicates of certain kinds of machinery which experience demonstrates is likely to give out when in use. A potato digger in stony soil is such a machine, and while my acreage in potatoes is not sufficient to require two diggers, yet I have an extra one in readiness if one breaks down. Three years ago I thought of purchasing a potato sprayer of a little larger capacity, but the price was so high that I thought I would wait until prices went down after the war. In July, 1918, our sprayer broke down when we first began to use it, and we were delayed in getting repairs. In the meantime late blight developed to a large degree. We sprayed thoroughly the rest of the season, and perhaps would have been all right if it had not been a rainy fall. But the fall was rainy, and we had fallen down in our preparations for such an emergency. The consequences were that we lost money enough to have bought five new sprayers at war prices.

The crops farmer in our climate is usually at a loss to find ways to employ his men during the winter season. I have found a farm shop, where all harnesses and machinery can be overhauled, repaired and all weak parts renewed, to be a splendid investment. Every day spent at this work in winter saves a day at a critical time in summer. With a full complement of machinery all overhauled and repaired, and every piece ready for use the day it is needed, we have eliminated a big source of risk.

Labor.

Our next factor is that of labor. Farm management studies have shown that the farmer's labor income is conditioned upon his doing a business of good size. This means that most farmers must hire labor to supplement their own. Ability to

get labor will depend upon making the farm job pay as good wages and offer as good working conditions as industrial competitors are offering.

Since the farmer's work is seasonal, it has been too much the custom to hire in the spring and fire in the fall. Such a job is not a good one, and we can never expect to get good men on our farms unless we offer all-the-year-round employment. Even though profitable employment cannot be found in winter, it is sometimes good business policy to carry good men through the slack season, so that they will be available when needed.

Men who work on farms like homes of their own, and those farms which have tenement houses for their men seldom have labor troubles. I have never advertised for a man and offered to provide a house, without receiving a number of good applications.

I am a believer in the profit-sharing plan as a means of interesting men in my farm business. A good man will not always work for wages. He will save until he has capital enough to start as a tenant farmer or to purchase a farm for himself; then he will start a business of his own. If we are to keep such men with us we must give them an interest in our business through some system of profit-sharing which will give them something more than ordinary wages. I have had such good success with this plan that I can recommend it to you. Not every man will appreciate it sufficiently to work under it, but for those who will, it is a wonderful incentive to stay on the job and do their best in the farm business.

Markets.

The next and final factor in our discussion is that of markets. Our crop raised, are we to receive a paying price for it, or are we to find a glutted market and an unprofitable price? This is a risk which the farmer fears as much as any other in normal times. How are we to avoid it? Diversity of crops will help. If we put our eggs all in one basket, we stake our all on what happens to that basket. Perhaps under certain conditions it will pay best to do so, after all. Aroostook County, Maine, is an example of a section which depends almost entirely upon

the potato crop for its farm income. That section has such ideal conditions for potato growing that a good crop is almost sure. When something happens to the crop in other sections of the country, so that prices are high, the Aroostook farmer makes a "killing;" when there is a big crop in the country and prices are low he loses, but the general average is in his favor, so it pays better to concentrate on potatoes. Personally, however, I would not care to run the risk, and prefer to have three or four specialties so that if one fails the others may make up the loss.

Another way of avoiding market risks is to contract for the crop at a stated price. I have done this with string beans and potatoes with good success, but the average is probably not much better than to take one's chances in the market. It is always good policy for a farmer to study market conditions and crop-planting tendencies and vary his crop acreages within certain limits accordingly, although in the long run it is perhaps best to plan out a steady course and keep to it. The man who plunges into certain crops now and then in speculative fashion usually owns supplies when prices are low, and is out when prices are high. Even though acreages planted to a crop are unusually large, we always have the possibility of unfavorable growing conditions which will cut short the crop of the unskilled grower and reduce the production. I am of the opinion that the man who diversifies his crops, who contracts for a portion if his financial condition is not such as to enable him to stand a bad year, and who is a skilled grower so that he can raise good crops in a bad year when prices are high, will not suffer in the long run from market risks.

Now if we have done our best to control all the factors we have enumerated, if we have carefully prepared our land for the worst season that may come, if we have sown good seed and have had enough labor and machinery to handle our work carefully and promptly, then in the words of Paul, "having done all," it is ours "to stand" and take what comes. There will perhaps still be some near failures, but from my experience I believe they will be few. Nature is exacting but not fickle. He who learns her laws and how to co-operate with her will find her ready to yield her bounty.

Mr. Howard. I would like to inquire from the speaker as to how many men he would care to put in a tenement? How many he would think advisable if he had 20 to 40 men? I would like a little light on that.

Mr. Brigham. That would depend somewhat on the size of your business and upon whether you could give winter employment to that number of men. It would also depend upon whether you could get summer help; that is, what you want, very readily. If you don't need 20 men the year around, and you can readily get summer help, why, I think it would be best for you to provide houses for the number of men that you want to carry through the year. That is what I should do.

Chairman Stone. I would like to ask the Commissioner if he has any trouble in hiring these men, getting a man on the place, getting him moved there, him and his family, and then finding he isn't suitable to do the work. What are you going to do with him? Do you have trouble in getting rid of him?

Mr. Brigham. Well, of course, if you install a man in a tenement house, especially in the spring of the year, and he plants his garden, you are under an obligation to keep him through the season. If you start in in November, you can perhaps get rid of him in the spring honorably, but you have got to make the best of a bad bargain probably for a year. Use the greatest care that you can in getting your men. I haven't had a great deal of trouble from that source. I have had some pretty unpromising characters, but we were able to get along with them. Some of them improved under our instructions. Get him interested in your business so he looks ahead to something; that is the secret.

A Member. What per cent of the profit is the help entitled to?

Mr. Brigham. That would depend somewhat on your profits.

A Member. Do you consider you should pay them their full value in salary?

Mr. Brigham. Why, pay them the value of a common laborer, or for a laborer doing that class of work for which you employed them. Now, I figure that if you get the right kind of a man and give him an interest in the profits he is going to work enough harder and be an enough better man to

earn in addition to his wages that sum which you will pay him out of the profits. He won't be so particular about stopping at 5 o'clock. He will want to see the work go on. You know Mr. Hoover said, in an article in the "Saturday Evening Post," that the farmer was the only one who had maintained his production because he was interested in his own production. Now, a farmer has so much work ahead of him to do he isn't thinking about hours. He is thinking about doing that work and raising that crop. Now, he gets his wages out of the crop, but the wages are quite remote, so he isn't thinking about an eight-hour day, and for that reason the farmers of the country have maintained their production in the face of a falling off of a large per cent in the production of all other classes of industry. Now, if you can get a man interested with you to take that same view with reference to your farm business, you are going to get enough more service out of him to pay that extra cost.

A Member. Supposing the farmers should adopt the eight-hour principle, and work only eight hours, they would produce less. Consequently, their crops would bring more money, because they would be more and more scarce. How would that theory work?

Mr. Brigham. I think your theory is correct. If the farmer adopted the eight-hour day, — and I don't see any reason, if the rest of the world is going to have an eight-hour day, why the farmer isn't entitled to it, — if he does adopt an eight-hour day, I should predict that our consuming population would pay double, nearly, what it does now for its food products.

A Member. Why not?

Mr. Brigham. What do you say, Mr. Harwood?

Mr. Harwood. I think so.

Mr. Brigham. I think some would go hungry, too.

Mr. Harwood. I can't give you any reason why he should. I am with you on that.

Mr. Brigham. But the fact he does, as Mr. Hoover explains, is because he is interested in his business.

A Member. I have been working that way for seventy-five years, and I am paying more for my help one year than I ever earned and laid by in ten years. He isn't worth as much as I was at that age.

Mr. Brigham. I think it was Secretary Lane who said that what we needed to conserve most in this country was a man's interest in his work, and I think that we have lost something when we turn from the standpoint of working to accomplish something to the standpoint of working by the hour. We have lost a lot of interest out of life. I would like to see some plan evolved whereby other industries could come back and develop that interest in men so that they would be willing to work for the cause of production rather than simply by the hour. That is the big problem ahead of us.

A Member. I noted this past season, although everything was high priced, that we fellows were selling our goods just as cheap, many of them, as we were five or ten years ago, and they would only give us 1 cent an ear for corn, and we wouldn't take it. That is this year, and what are we fellows going to do? If everything is high priced but the farmers' goods, and they won't give us enough so we can afford to pick our corn, it is about time something was done.

Mr. Brigham. That isn't always going to last. It can't last. It is absolutely impossible for it to continue. It will work itself out, I think, within two years. Either prices of agricultural products have got to go up, because a lot of people go out of producing them, or else labor has got to go down. One of the two things has got to happen. Now, which it will be, I don't know.

A Member. Now would be a good time. There never will be a time when the pendulum swings only one way.

A Member. I would like to ask the speaker what wages he has to pay in his section.

Mr. Brigham. Well, men by the month, ordinarily men by the year — we pay this present year $55 per month, house rent, fuel, milk and other perquisites, which makes a total comparing rather favorably with the competitive wages, if we don't count the overtime. Now, we have had to shorten our day. Can't help it. The men simply won't work when they see their neighbors on an eight-hour day getting the same wages or a little more. They are not going to work eighteen and be satisfied or work a twelve-hour day and be satisfied, so while we are expected to work the same length of day we

always did, as a matter of fact we don't. We are trying to overcome that by machinery. We hire a good deal of piece work. We are situated where we can get a large number of women. We try to work them in wherever we can, but I rather feel that at the present time business is in sort of an unsatisfactory situation because we cannot pay the full wages and give the same working hours — I can't afford to — that the Railroad Administration has established. Our town is a railroad center, and that is our main competition.

A Member. With your experience in life, would you advise a young man to go into farming or go into something else?

Mr. Brigham. Well, I asked that question when I was a young man of one of the best farmers that you ever produced, I think, in Massachusetts, the late Mr. A. W. Cheever, who, at that time, was editor of the "New England Farmer," or a contributor, and he wrote me a long letter, I remember, when I was in the high school. I asked him that question, and he referred me to, and I believe bought for me, Donald Grant Mitchell's "My Farm of Edgewood," in which Mr. Mitchell answered that question. I believe that agriculture is the basic industry. We cannot get along without it, and I believe that in a series of years conditions are bound to be such that a man who follows farming, and follows it efficiently, is going to make a good living, and something besides. He won't be a multi-millionaire. He may not. I never saw but one farmer, in fact, who got to be worth a million. He lived in Norfolk, Virginia; a farmer down there got to be worth a million. He is the only specimen of the kind I ever saw.

A Member. Did he do it all on the farm?

Mr. Brigham. Well, he made investments as he accumulated money.

A Member. Did he make it on the farm?

Mr. Brigham. I do not know about that, but he was a very fortunate farmer. That is where he made his money — where he got his start. Of course, then he made something out of investments, as he accumulated money. But I believe there is something in farming, and there has got to be. If the industrial structure of the country is safe, I believe in a long series of years farming has got to be a good business, and I

believe it is up to us to make it a good business. We have got to make our voices heard in the counsels of the government to get a square deal more than we have in the past, and I think that conditions have got to be better and will be better.

A Member. Let us hope so.

A Member. I have eight boys, and they were raised on a farm, and there was only one of them that wanted to stay at home. When they got ready to leave home, after they got through school, they said, "Father, what are we going to do?" "Well," I said, "get your schooling, and I will be sure then you will go into some sphere you are adapted for," and so there is only one of them that wanted to stay at home. He is making a success of it. I do not believe the others would be making a success of it if they stayed at home. They did not care enough about it. That is the boy I would like to see on the farm.

Mr. Brigham. Of course, a boy must have a liking for the job. I believe it would be absolute torture for a man to farm if he did not like it; but a man who has a liking for it, I believe, would not be happy anywhere else. I should feel that something had gone out of my life if I should lose my farm and couldn't have another, because I like it.

The Commonwealth of Massachusetts
DEPARTMENT OF AGRICULTURE
ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 17
June, 1920

THE SMALL AGRICULTURAL FAIR

OLIVER E. REMEY

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

THE SMALL AGRICULTURAL FAIR

OLIVER E. REMEY, SECRETARY OF THE WISCONSIN STATE FAIR.

Within the United States to-day there are more than 3,000 large and small fairs, expositions and allied displays, representing a total investment of over $80,000,000, and attended during each year by over 40,000,000 people, — a number equal to one-third the population of this great land.

Actively engaged in management, direction and realization of these fairs, expositions and allied shows are over 1,000,000 earnest men and women, a vast majority of whom have right ideas, and are striving to educate and inspire through their fair work. More money is paid out in premiums at *bona fide* fairs and expositions than is taken in at outside and grandstand gates. Villages, towns, counties, States and the Nation annually contribute liberally of their funds to fair work.

Although fairs and expositions have existed since society began to concentrate on marketing facilities, their great day is just dawning. During the past few years a decided change has taken place in the fair, both large and small, — a change tending toward all-year influence in the community, rather than a one-week round-up display. Night also has fallen on objectionable features of fairs. The immoral show, the crooked concessionaire and the misleading exhibit are folding tents and stalking toward oblivion.

The fair is taking on new and wider activities. The up-to-date fair not only shows the farmer and allied worker how to accomplish greater and better production, but it shows him, among many other things, what sort of home to build; how to furnish that home; how to build and maintain highways; how to protect his life and the lives of his family, and of his live stock, against disease; how to prepare his products for the

market, and how to get in touch with the best markets; how to build and furnish model schools; brings together for his inspection and purchase all that is known to the farm machinery world and the motor world; and how to obtain more than he now receives of money that ultimate consumers pay for products he produces.

The up-to-date fair, while basically organized and operated for the farmer, does not forget town and city people, and for them adds a varied array of educational and inspirational features. Town and city residents make up a large majority of consumers of products of the agriculturist. It is one of the missions of the fair to bring closer producer and ultimate consumer, for when they become commercially acquainted many evils bitterly complained of gradually will fade. The up-to-date fair is not afraid of activity and expenditure of effort and money for public good, and it is its duty to accept every line of work that will bring results.

Object-lesson an Effective Educator.

During the past few years no institution has made such decided steps toward increased results as an educator. The fair is no longer satisfied to dominate the large community, but it is entering remote sections of every State, throwing the sunlight of its good influences everywhere. Every progressive State has its State fair or exposition; some States more than one in this class. Districts of States have their fairs, where several counties compete with each other. Every live county either has a fair or is preparing to have one.

During the past five years the community fair has taken a fixed place in the ranks of fairs, and it is multiplying at a rapid rate, until the day seems not far distant when every rural schoolhouse will be a community fair center as well as a common school. The fair has found its place in the social structure, and every year, through improved methods, it is making that place more secure. With due respect for other forms of education, none is doing more effective work than the fair, for the reason that no method of education is as effective as the object-lesson. Excepting the common school, few forms of education so nearly reach all the people. The fair not only reaches all

the people, but it keeps after them until it surely has them interested.

While larger fairs are the show places more generally before the people, it is the smaller fair through which the greatest good is accomplished. Smaller fairs are feeders for larger fairs, but they perform a far more important function than that. They build up their respective communities. They represent the tendrils, so to speak, that reach to the very ends of the world in the intensive training which fair work accomplishes.

Include All Agricultural Agencies.

The organization to operate the fair having been perfected, we will say on the plan of annual and life memberships, the plant having been located and decided on, it is necessary to perfect thoroughly the plan of management before the first classifications for premiums have been outlined. The organization operating the fair will of course handle the affairs of the organization, but the officials of the fair should have the advice and co-operation of all agencies in the county and State associated with agricultural work.

In the first place, each State should have supervision over all of its fairs, big and little, whether they receive State aid or not. This supervision is best exercised through a State Department of Agriculture. This department should have direct charge of the State fair, if operated by the State, and it should exercise supervising influence over every other fair through rigid inspection. The State Department of Agriculture should have on its staff men and women well versed in fair work, and the department should at all times be ready to give advice to fair officials during periods of preparations of fairs. The plan followed in Wisconsin, and to some extent in other western States, is for the Department of Agriculture to have entire charge of the State fair, a board of one member from each congressional district assisting in advisory capacity. The State fair is a division of the Department of Agriculture. With the State Department of Agriculture advising and supervising, next establish co-operation with colleges of agriculture, farmers' institutes, county agents, breeding associations, agricultural associations and farm boys' and girls' clubs — in fact, enlist the co-opera-

tion of every individual and organization engaged in agricultural or allied work.

As to the county fair, I say that if you neglect to enlist the county agent in your fair you have committed a blunder which should make necessary a new set of officers. The county agent is the county agricultural leader, and if he is properly enlisted he can greatly assist to interest all the rural people in the county in the fair. Please do not get the impression that all of the various agencies I have mentioned shall be in control of the fair. Officers of the fair, under supervision of the State Department of Agriculture, should be in absolute control. Seek the advice and active co-operation of the other agencies, using advice when it is good and disregarding it when it is not good.

Select Manager with Care.

With reference to officers in charge of the fair itself, select the best man to be found who shall practically manage the fair, under the supervision of a board of directors. When you select this man choose a conscientious live wire, — the most alert, active, keen-minded diplomat you can find, and be sure that he is a hard worker, has good business judgment and is resourceful. When you find the right man, give him plenty of authority, pay him well, and, instead of hindering him, help him run things. Some fairs make the mistake of choosing as their fair officers men and women who are unfitted for fair work. Others make the fair a sort of haven for failures in other walks of life. A business enterprise of the magnitude of most any fair in a live county would first engage a good man as manager. Why ordinary business sense should not be followed in county, State and national work is more than I can fathom.

In the management of the fair probably the first impulse will be to place in charge a farmer, or one well versed in agriculture. This is a good policy, providing the man is a good fair man, or will soon acquire efficiency in this direction. Do not assume that because a man is a farmer he should make a good manager of a fair. Training for agriculture does not of itself make an expert fair man, any more than training for any other walk of life makes a fair man. The point is, fair management is a

calling peculiar to itself, and one successful in this calling must have qualities peculiar to fair direction. The salary attached to the position of secretary or manager of a county fair should be such that it would attract desirable talent.

A mistake a large majority of county fairs make is to delay planning and working for the annual fair until a few weeks before the annual fair period. No sooner does a fair end than its officers should immediately begin work for the fair of the year following. Let your secretary or manager form a sort of partnership with the county agent, and be at work the entire year. How can any one expect the people of any county to be as greatly interested in their fair as they should be, unless the fair is kept before them during the entire year? It is possible that some who have helped to conduct small fairs are now trying to figure out just what a manager of a small fair can do to keep busy the year round. Later on I will show how he can keep busy.

Chief Mission of the Fair.

Your fair plant having been settled upon, and co-operation established with all agricultural agencies in the county and State, it will be necessary to organize the first fair. First, let us see what the fair chiefly aims to accomplish. Its first big mission is that of encouraging production. Its next mission is that of encouraging the right kind of production. This encouragement is attained principally through offering premiums for agricultural products, live stock, horticultural products, dairy products, farm women's work and farm boys' and girls' work.

In arranging classifications many important conferences should be held to determine for what premiums shall be offered. For instance, twenty varieties of potatoes may be cultivated in the county. Do not offer premiums for each variety of potato; find out those best adapted to the county and offer premiums for those varieties only. It is possible that every breed of cattle known to the civilized world may be represented in the county. This does not mean that all should be encouraged, for undoubtedly some breeds are raised through whim and not because of commercial value. Find out what breeds of cattle, horses,

sheep and swine should be encouraged, and offer premiums for them only.

I have been asked several times to arrange a model premium list for smaller fairs of my own State. There can be no such project as a model premium list covering an entire State, for what should be encouraged in one section of the State probably should not be encouraged in another, because of climatic and soil differences, or because of marketing or transportation problems. In such cases the advice to be given is that the fair officials, through a survey, must ascertain, with the assistance of agencies mentioned, those products worthy of encouragement in the county.

Help to solve Farm Labor Problem.

Now, the up-to-date fair has many ways of encouraging production in addition to the awarding of premiums. Farm labor is becoming scarce. The old-time farmhand, who worked like a slave for small wages, has disappeared. If farm work is to be done, some one, or something, must take the place of the farmhand. The live fair of to-day presents to its patrons as large a display of farm machinery as it is possible to get together. It is the duty of the fair to present to farmers of its territory everything possible in genuine farm machinery, tractors, motors, silos, well machinery, farm home lighting plants, and so on. Last year, orders taken in the farm machinery section of the Wisconsin State Fair exceeded one and one-half millions of dollars, and the purchases were made almost entirely by farmers. Fair managers will find machinery, motor, tractor, lighting and other companies manufacturing products for the farm ready to co-operate by putting on displays at the fair. These companies should not be charged for the space assigned them, for they help materially to make the fair successful.

Help to solve Marketing Problems.

Still another method of encouraging production, in addition to offering premiums, is in presenting information with reference to marketing. I can best illustrate this by telling you that the 1920 Wisconsin State Fair will present marketing features in every department. It will show how to prepare products for market,

and it will give advice showing how to get into the best markets. This work will be in charge of the State Marketing Commission.

This is one line of work at which the secretary, or manager, of the fair should be busy the year round, and if he does the right kind of work in showing residents in his county, perhaps co-operating with the county agents, how to best market products, many thousands of dollars will be reaped in benefits by residents of the county. When the ideal state of affairs is reached, wherein products of a State are purchased in the State, the surplus only being sold outside, a decided setback will be encountered by the high cost of living. It should be one of the duties of the county fair officers to help this project along.

Keep Boys and Girls on Farms.

The county fair should be a sort of civic and social center, with branches reaching out to each rural school, the home of the community fair. To-day the Young Men's Christian Association, the Young Women's Christian Association and other fine organizations of this kind are unwittingly helping to lure the farm boy and girl away from the farm. Fine edifices are erected by these organizations in the big cities and thriving towns. Dormitories, reading rooms, swimming pools, club rooms and gymnasiums are beckoning to the farm boy and girl. Is it not but natural that the farm boy and girl, used to long hours and the fewer conveniences of the average rural home, are anxious to get to the cities and towns where so many fine things are provided for them?

If the farm boy and girl are to be kept on the farm, some of these latter-day conveniences must be brought to them. Club rooms, swimming pools, athletic fields, reading rooms, better home conveniences must be brought within easy reach. Let your county fair grounds solve this problem. Build a club house, with all the modern equipment, on your county fair grounds, and let your fair secretary, or manager, and your county agent see that your county club headquarters are made so attractive that your farm boys and girls will forget the lure of the city, with its enticing conveniences.

This work will serve to take considerable of the effort and time of your fair secretary, or manager, during the entire year.

In this connection see that your fair builds up a strong farm boys' and girls' department. You will find it will be the best feature of your fair. You will find that this department, also, will help to keep the interest of your farm boys and girls at home.

Exhibits by State Agencies.

State departments of agriculture and colleges of agriculture should take advantage of all fairs within the State to reach the people through exhibits. Colleges of agriculture, and State departments of agriculture, for instance, should present comprehensive exhibits demonstrating necessity of use of pure seed, use of fertilizer, weed control, grading of products and similar lines. Departments of agriculture should be called on for various exhibits reflecting work of divisions of entomology, horse breeding, immigration and live-stock sanitation. These exhibits should include all work of both colleges of agriculture and the State departments of agriculture which apply to the county. Then there are many other departments of State government which should be called upon for exhibits, such as highway commissions, departments of education, health departments, industrial commissions, employment agencies, and so on.

It will be found that these exhibits are forthcoming almost for the asking, for those in charge of these various agencies are as anxious to get in touch with the people of the county as the county is anxious to have them show what they are doing.

By confining your efforts and funds to work along strictly production lines, and calling upon agencies such as I have suggested for the most spectacular features of encouraging production, you will be surprised to see how easily and quickly a really worth-while fair will be realized.

How to make Exhibits Attractive.

Limit of time will not permit me to take up all the basic departments of the average county fair, or any fair, and show just what ought to be done in the way of exhibits in each department. However, I will take three departments and make suggestions which may be followed throughout the fair.

The modern dairy department does not stop at displays of butter, cheese, milk and cream. The up-to-date dairy depart-

ments will show, for instance, a herd including from six to twenty dairy cows. It will show them installed in model quarters, how they should be looked after, what they should be fed, and how much they should be fed, say, for one year. These cows will be milked before patrons of the fair, demonstrating use of the milking machine and cleanliness of milking methods. Care of the milk will be demonstrated, also separation of cream from milk, and, if possible, the actual making of butter and cheese, and preparation of dairy products for shipment to market.

The women's work department should not be confined to arrays of garments, fancy work and cooking. Get something into this department that will be of real service to farm women. For instance, present a display of dresses best adapted to use on the farm, cutting patterns, making the garments and displaying them on living models before farm women. Another display worth while for this department is one showing how to furnish a rural home and how to arrange furniture. The Art Institute of Chicago presents an exhibit of this kind that is very instructive. Another feature for this department is demonstrations of cooking by farm girls, taught through the agency of the farm boys' and girls' clubs. The fair should be filled with demonstrations.

In the department of education exhibits usually are confined to work of school pupils. Provide an exhibit showing the model school and model school furniture, so that school officials of your rural communities may profit by seeing them.

Many fairs, large and small, present what they call a fine arts department. Shun any such travesty on real art. I know of but one fair in America that has a real fine arts department, and that is the State fair of Texas. Hundreds of thousands of dollars have been spent on this exhibit, and it contains real art.

Provide High-class Entertainment.

Now we come to a very important feature of fair management — that of its policy in providing features in addition to real educational exhibits. In other words, shall there be entertainment features and how much entertainment shall be provided? As I said earlier in this discussion, fairs should be built

for all of the people. While the agricultural fair is basically organized for improved agricultural production, it should give consideration also to people of towns and cities. If your fair is given State aid, people of the towns and cities pay about 60 per cent of this State aid, because they pay about 60 per cent of the cost of the State government. They also do not win many, if any, of the premiums.

The slogan of every fair should be to educate, inspire and entertain. There should be some relief from the serious methods of educating patrons, and this relief is furnished best through high-class, clean entertainment. Rural people will appreciate entertainment more than the town and city people, because they see less of it. Harness racing helps to entertain, and at the same time encourages breeding of the light harness horse. Harness racing, also, is not an expensive form of entertainment. The big fairs find that they cannot buy for what harness racing costs other features that will take the place of harness racing and hold the crowds. Vaudeville acts, circus acts, aviators, balloonists, merry-go-rounds and other riding devices and instructive shows, such as model cities and clean pay-shows that do not offend, should be provided, for your patrons want them. Plenty of good, lively music is essential. You will hear some protests against entertainment at fairs, saying that it detracts from the educational features. Do not take these protests seriously. Without entertainment your attendance will be seriously cut down. Be careful, however, in providing entertainment features not to forget the basic departments or the real missions of your fair.

Fair responsible for Moral Tone.

No fair in America presents a better array of high-class entertainment than the Wisconsin State Fair, running the scale from pay-shows through automobile, motorcycle, harness racing, vaudeville and circus acts, aviation and fireworks. The services of a first-class stage director and twenty-two stage hands are required to put on these acts, staged as they are staged in any first-class theater. But all the time efforts of officials are centered chiefly on the fair itself, so we have a first-class fair for those who do not care for entertainment, and a first-class

fair and high-class entertainment for those who want both the fair and entertainment. Although the Wisconsin State Fair spends over $50,000 annually for racing and other entertainment features, these expenditures do not cut down the amount of money paid in premiums or spent for real educational exhibits in the thirty-two departments of the fair.

One important fact to be remembered is that a fair is an institution peculiar to itself. You must have all the features associated in the average mind with the name "fair." A big western fair a few years ago decided to have nothing but the fair itself, and cut off all entertainment. The fair proper was the best this State had presented up to that year. But the fair was dead. People went away believing the fair had "gone back," so to speak. The following year all of the entertainment features were restored.

As I have said, do not let entertainment features dominate to the disadvantage of the fair proper, and by all means do not provide anything that possibly can offend any one. Officials of fairs are in absolute control of their grounds. If they allow anything of an objectionable nature to be presented they solely are to blame, and not the promoters presenting the objectionable feature, and the public should hold the fair officials responsible.

How State Aid is given.

Some States do not give State aid to fairs. All States, however, should give State aid. The system followed in Wisconsin is as follows: —

The State operates the State fair. On March 1 each year $140,000 is turned over to the State fair for operation, and $10,000 for maintenance, and officials of the fair are allowed to enter into percentage and agency contracts in presenting amusement features. In addition to the State fair there are over eighty district and county fairs receiving State aid, amounting to about $180,000 a year. Each district and county fair receives 85 per cent of the money paid out in premiums, excepting for speed events. After the close of the fair officials must file an affidavit showing how much was paid out for premiums, and that no objectionable shows or

gambling devices were allowed on the grounds, and that no liquor was sold. This affidavit is filed with the Secretary of State and passed on to the State Treasurer for payment. No fair receives more than $5,000, this limit being fixed because among the district fairs are three or four of magnitude almost equal to some State fairs.

Right here I wish to say a word of warning. Strive ever to keep the fair up to a high standard. If once the fair starts to go backward, it will require much time and additional expenditure of money to retrace the backward steps.

Get Results from Judging.

Many fairs neglect to obtain all possible results from judging. Exhibitors are awarded premiums, and really do not know exactly why they receive them. Other exhibitors see premiums awarded for exhibits presented by others, and are not told why they lost. This is a serious mistake. If possible, at the conclusion of judging see that judges tell just why, at least, the highest premiums were awarded. This cannot be done very well at a large fair, but it certainly should be done at all small fairs. The award of the premium furnishes the educational results of competition. The live-stock exhibitor who sees his animal beaten in the show ring when he thought he should have won, and is told exactly why he lost, goes away satisfied. Chances are that he will overcome points in his live stock which lost him premiums he expected. This applies all through every department.

In the farm boys' and girls' department, judging by the boys and girls is an effective feature, both for the boys and girls and for spectators as well. Every fair should make it a point to promote the boys' and girls' department in every way. The boys and girls of to-day will be the older exhibitors later on, and through their competition during youthful days will become life-long patrons of the fair.

Obtain the best judges available, and see that no partiality is exercised. Be insistent on all awards being made solely on merit. In this way commercial worth is given to the premiums offered, and competition is made keener. To award premiums excepting upon merit is to nullify the value

of the premiums; also make symbols of premiums — ribbons and cards — as attractive as possible, for in all likelihood winners will keep them many years.

Use the Budget System.

Plans covering all expenditures of funds should be carefully made. The best plan is to conduct the fair, no matter how small, on the budget system. Intelligent and effective apportionment of funds available cannot be made without careful study, and the budget system provides means for this careful study. In planning expenditures, funds for premiums especially, ascertain through careful calculation about what receipts will be, then outline expenditures according to probable receipts, leaving a safe margin as a contingent fund. Build the fair for average weather. No one can accurately forecast six months ahead probable weather of a given period. If the fair is built for average weather, the wisest course has been followed. The public ought not to criticize if rain or cold weather ruins attendance.

Be careful to conduct all financial transactions under a proper system of accounting. Issue a receipt for every payment received, and insist on having a receipt for every payment made. See that books of the fair are open to any one who cares to examine them. The fair well managed has nothing to hide from any one.

Every exhibitor in competitive departments should be required to pay an entry fee equal to the cost of a season ticket, and a ticket should be furnished on receipt of the entry fee. Premiums should be spread as far as possible. Do not offer all the money available for three or four premiums in a single classification; ten premiums get better results than three or four. The small exhibitor must be encouraged.

It is an open question whether a county fair should accept exhibits from another county. If the fair is young, it is advisable to confine all exhibits to the county, until quality and quantity of county exhibits are such that outside competition is not to be feared.

Pay premiums and all other obligations promptly — during the fair period if possible. Nothing pleases exhibitors so much as prompt payment of money they have won.

Methods of obtaining Publicity.

Do not "hide the fair under a bushel." This means that it is very important to advertise the fair properly. Nothing will serve to build up a fair more than the right kind of publicity. One strict rule to be followed is this: never advertise a feature of the fair unless absolutely certain that it will be shown. The publicity campaign should begin in earnest at least six weeks before the fair period. There should be something in the newspapers of the county concerning the fair the year round, but the intensive campaign should cover at least six weeks. Use all the newspapers of the county. Do not expect that the newspapers are going to promote the fair for nothing. See that they receive as much paid advertising matter as you can afford to give them, and by no means stint on this expenditure. The newspapers will willingly run much news matter, if they receive a fair share of paid advertising. Next to newspapers use billboards, even though billboards are in many localities considered eyesores. The fact that billboards are worth while is pretty well established through use of billboards by newspapers themselves.

After funds have been apportioned for newspapers and billboards, other forms may be used, if money for them is available. However, do not enter into every form of advertising that is offered. The aim should be to reach every man, woman and child in the territory at least once with something of interest concerning the fair.

Some fairs publish a monthly fair bulletin, sending it to a selected list. This bulletin is devoted entirely to the fair and its features. This is an excellent form of publicity and gets good results. It is quite costly, especially since price of paper has advanced so greatly.

Do not be afraid of criticism. Welcome honest criticism at all times, and be prepared to hit unfair criticism on the head, in a high-class way, any time it appears.

An effective publicity departure is that of admitting free of charge all school children on a particular day, preferably on the opening day. Induce the school authorities to close

schools in the territory on the day selected, and for that day provide as many features as possible appealing to school children. The attendance of school children on Children's Day last year at the Wisconsin State Fair was 42,352. The school children went home and told members of the family not present of the wonderful things they saw, and perhaps induced many to attend the fair who would not have attended without the publicity given the fair by the children.

What the United States Government has learned.

I have set forth the necessity for fairs to establish co-operation with departments of agriculture and colleges of agriculture and other like agencies. Really, it ought not be necessary for fairs to seek this co-operation, for it should be forthcoming without seeking.

Two years ago the United States Department of Agriculture began to send exhibits to the larger fairs. Results were so excellent during the first year that congress appropriated $100,000 a year, one year ago, to pay the cost of these exhibits. I understand that it is the ultimate aim of the United States Department of Agriculture to add to its exhibits until small fairs receive them everywhere. If the United States government obtains results warranting such extensive plans, why cannot State governments obtain equal results? I would say to all State departments of agriculture and colleges of agriculture, get into every fair of your State with an exhibit. If this is not being done, a fine avenue for reaching rural people is being neglected, and some one should be called to account.

Western fairs choose many of their judges from faculties of agricultural colleges, and they also employ members of faculties as departmental heads of the fairs. Some colleges of agriculture are attempting to assume fair functions in presenting annual exhibits at the colleges. The time is coming when this departure will be turned over entirely to fairs of the State, as it should be.

Supervision and State Associations.

I am a strong advocate of States having supervision of all fairs presented within their borders, even though some fairs may be owned privately and operated on private capital. Proper State supervision not only insures right moral tone and direction along desirable educational lines, but it insures for the struggling smaller fairs assistance greatly needed.

Each State should have a staff of expert fair men and women for the purpose of assisting in the organization and direction of its fairs. No State has as yet reached this point in its fair supervision, but it is coming, and soon. Every State should have an association of fairs which conducts each year a convention during which questions vital to fair work are discussed thoroughly. Several States have these associations, which not only provide solutions of many serious questions of management, but they serve to obtain proper recognition for fairs from State and the national governments. When a committee representing every fair in a State appears before the Legislature it commands immediate attention, for members of the Legislature know this committee has the power of a giant at its disposal. Search through the fair personnel in any community, and it will be found that the best men and women are identified with the fair. Members of Legislatures know this. If any State is suffering for want of proper legislative recognition of its fairs, it is because the fairs of the State have been lax in organizing.

The State Department of Agriculture is the logical organization to have supervision over fairs. If fairs of a State are organized, they also will be in shape to combat any unfair supervision that may be exercised by departments of agriculture, or other supervising authority, which may be experienced in remote instances.

Reorganize when Found Necessary.

This discussion, it may appear to some, is chiefly along lines of aid to the newly organized fair. What about the small agricultural fair that has been in existence for many years, and which is found not to be as progressive as it should be?

Officials of this sort of fair should begin at once a reorganization, and many small agricultural fairs are undergoing this process.

The world has made wonderful strides during the past four years. Progress seems to be the watchword everywhere. The unrest in which the world to-day finds itself is simply a progressive reorganization of society in many directions. Above all, the fair must be kept right up to the minute. It cannot be as impressive an educational and inspirational influence as it should be, unless in the very lead of thought and action in its territory. This is still another reason why its chief director should be a man who is always alert and quick to make use of progressive methods and departures.

In 1918 I attended a small fair which has a wide reputation for large attendance, and which has been in existence for many years. I was struck with the evident lack of progressiveness. Some of the officials of this fair must have been impressed as I was, for beginning last year this particular fair is going through a complete reorganization.

So conduct the fair that a reorganization will not be necessary. It is very difficult to retrace a backward step in management of fairs. Watch keenly to keep right up to date, and reorganization will not be necessary. One very good method of keeping up to the minute is by reading of what other fairs are doing, by examining carefully premium books, and, if possible, by visiting other fairs known to be in the first rank of advanced fairs.

Suggestions for Fair Managers.

Price of Admission.

There is a disposition on the part of fairs to raise the price of general admission.

The price should not be more than 50 cents.

The educational advantages of fairs should be within reach of every one.

No Charge for Automobiles.

Patrons of fairs are using automobiles more and more every year, instead of railroads, in traveling to and from fairs.

Admit automobiles free.

Make arrangements to park cars, free of charge, on the fair grounds.

Also make arrangements for parking just outside, so that cars can be looked after when all space for parking within the grounds is in use.

Organize Efficient Police Departments.

Every fair should have efficient police, not only to guard gates and fences, but to be of service to patrons in giving information asked for.

Insist on police being courteous, and also insist that they enforce all regulations.

Maintain a Bureau of Information.

Every fair should have a bureau of information located where it can easily be found.

Place in this office clerks who are thoroughly informed on every feature of the fair, so that patrons can be intelligently and quickly directed.

Eating Places and Reasonable Prices.

See that as many clean eating places as are necessary for accommodation of crowds are provided.

Have the State Board of Health inspect these places and the food served.

Allow no one operating an eating place to make exorbitant charges for meals or lunches.

Provide Supplies for Exhibitors.

Do not allow your exhibitors to be overcharged for supplies and forage.

Establish a department to furnish forage for live stock at cost, plus cost of handling.

Make your exhibitors feel that they are a part of your organization.

Restrict All Vehicle Traffic.

No vehicle traffic should be allowed on the grounds after 10 o'clock A.M. each day up to 6 o'clock P.M.

Give crowds every opportunity to get about the grounds without being impeded by vehicle traffic.

Supplies can be delivered to concessionaires and exhibitors before 10 o'clock each morning, and after 6 o'clock at night.

If necessary, establish supply depots for use during hours when vehicle traffic is restricted.

Do not allow Solicitors on Grounds.

Do not permit solicitors about the grounds.

If solicitors are allowed on the grounds, see that they provide a booth for their work, and remain in it.

Allow no organization, no matter how worthy, to conduct a tag day at the fair.

People come to see the fair, and should not be bothered while there.

Keep Fair Grounds cleaned up.

The fair should be a model in every respect.

Keep grounds clean and attractive at all times.

Free use of paint is mandatory. It not only protects buildings, but it serves to make the grounds look as though some one lived there.

Look after Health of Patrons.

See that health authorities of the community and the State supervise buildings and tents occupied by concessionaires.

Make everybody clean up, and stay clean.

Establish a System of Special Days.

Let your patrons know on what days certain breeds of live stock are to be judged. A good plan is to establish a "Jersey," "Holstein," "Guernsey," etc., day.

Have a "city" day and a "farmers'" day, and others, as conditions make possible.

Always be Courteous to Patrons.

Always treat patrons with courtesy, even when complaints may be unfair. Establish all regulations to the end that your patrons are given first consideration.

If you find a rule or regulation unfair, change it.

However, insist on enforcement of all rules and regulations.

Erect Buildings for Actual Service.

In constructing buildings, aim at practical service rather than beautiful architectural effects.

Adequate display of exhibits is of more importance than beautiful roofs and cupolas.

American production is of more importance than Italian art — at a fair.

Missions of Any Fair.

To define all missions of the fair would be a difficult task.

A fair is an educational institution, and it is its duty to educate along any line that will develop worth-while practical results.

Be considerate of All Suggestions.

Do not visibly despise a poor suggestion.

The fact that the suggestion is made shows that its maker is interested in the fair.

Everybody in the territory served should be interested in the fair.

Fair Work Publications.

There are a number of bulletins and circulars on fair work published by various departments of agriculture and extension services. I would recommend that every fair worker read the following publications and keep them for references: —

"Live Stock Classifications at County Fairs." Farmers' Bulletin No. 822, U. S. Department of Agriculture, June, 1917.

"The Community Fair." Farmers' Bulletin No. 870, U. S. Department of Agriculture, December, 1917.

"The Rural Community Fair." Bulletin No. 307, Agricultural Experiment Station of the University of Wisconsin, November, 1919.

"Composite Premium List and Judges' Score Cards." Bulletin of the North Carolina Department of Agriculture, April, 1918.

"Fairs and Their Educational Value." Extension Circular No. 69, North Carolina Extension Service, July, 1918.

"The Organization and Management of Fairs." Extension Circular No. 68, North Carolina Extension Service, July, 1918.

"How Co-operative Fair Work is Carried on in North Carolina." Bulletin of North Carolina Department of Agriculture, February, 1919.

"Some Results of Fair Work in North Carolina." Extension Circular No. 94, North Carolina Extension Service, June, 1919.

The Commonwealth of Massachusetts
DEPARTMENT OF AGRICULTURE
ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 18
March, 1920

Raspberry and Blackberry Growing in Massachusetts

S. L. DAVENPORT

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

3-20-2,500.

RASPBERRY AND BLACKBERRY GROWING IN MASSACHUSETTS.

S. L. DAVENPORT, NORTH GRAFTON, MASSACHUSETTS.

Massachusetts is not considered to be one of the most important fruit-growing States of the Union; nevertheless, we find in many sections of the State that the industry has developed very rapidly during the last ten years, and that to-day we are producing large quantities of apples, like the Baldwin and McIntosh, of the highest quality. Not only are we producing them, but grading and packing them correctly, and meeting the competition of the fine fruit from the West, and obtaining equally as good, and many times better, prices. What, you ask, has been the cause of this great awakening in fruit growing? Surely we must give considerable credit to the Massachusetts Fruit Growers Association and the fine work they are doing, and also to the State Department of Agriculture, the Agricultural College and agricultural schools for the education, encouragement and leadership they have given. However, I believe that we must give our fellow fruit growers of the West the credit for most of this awakening, for they, through their pioneer work and great success, have aroused us to the wonderful possibilities right here at home.

But most of this development has been with the large fruits, like apples, etc., and we find that very little has been done in developing the wonderful possibilities of the raspberry and blackberry. Here, again, I am wondering if it will not take the West to show us the great opportunity we have in growing these fruits right at home. Already large areas in raspberries and blackberries have been developed in the West, and are increasing rapidly, while we in Massachusetts are hardly doing anything at all.

What is the raspberry and blackberry situation in Massachusetts to-day? If for a moment we turn back to the last census report of 1910 we find that more than 650 acres at that time were devoted to the production of these fruits; but during the last ten years we find that the number of acres has generally decreased, and I feel that our 1920 census will show that the industry is not growing very rapidly in this State. However, it is safe to say that, although the production has diminished, the demand and consumption has greatly increased. Thus we find to-day that Massachusetts is producing only a very small per cent of the raspberries and blackberries consumed, and that the rest are being shipped to us from New York State and from the South. Therefore we wonder what are the reasons for this decline, and again, turning to the present and future, what are the opportunities to-day in growing these fruits.

There have been many reasons why the growing of these fruits have declined in Massachusetts, but I believe to-day that most of these reasons will not hold, and for the right man the growing of these delicious berries offers an attractive future.

In many sections of our State we find favorable soil and climatic conditions for these fruits, and with our markets at our doors our crops may be sold even before they are produced. Thus, again, we realize that we are most favorably located, for what is better than fresh ripe raspberries served the same day they are picked? Moreover, our markets for these fruits are growing wider and wider every day, for we find that with the coming prohibition the demand for fruit juices and other products is increasing rapidly. Further, we note the great development of canning and preserving plants, which are to be the great stabilizers of prices, and which will assure always a market for our crops. But right here in Massachusetts it will be some years to come before the supply will be able to meet the demand for the fresh fruit, and this fact will assure us high prices for quality products.

Now, before we take up some of the essentials of success in growing raspberries and blackberries, let us consider the various groups of these fruits. There are, we find, three groups of raspberries grown in this State: first, the red raspberries and a variation from the red, — the yellow; second, the blackcaps,

or thimble berries; and third, the purple canes, which are the results of the crossing of the red and black varieties. In this part of the country the varieties of red raspberries seem to be the most popular, and at the same time they are probably best adapted to this section. The blackcaps are, when well grown, a much sweeter berry than the red, and, owing to the fact that their fruit ripens practically all at one time, they can be harvested cheaper and thus sell for a little less. In some sections they have become very popular, owing to their high quality and cheapness. In sections of New York State the blackcaps are used very extensively for drying and canning. There may, however, be some question whether it is advisable to try to grow them commercially in Massachusetts. They should, however, be given a trial. The purple canes, which make up the newest group, seem to be well adapted to various sections of the States, and although they are not as attractive in appearance nor as good shippers as the others, they are wonderfully prolific and of good quality. They are becoming more and more in favor, owing to their hardiness and extremely heavy habit of bearing.

The blackberries we may divide into two groups: first, the blackberry; and second, the dewberry. We are all familiar with the blackberry, and if we have had the privilege of eating it ripe, from the vines, we appreciate what a fine fruit it is. The dewberry, or trailing blackberry, is not as well known, but in sections where they grow to perfection they are not only larger, but more juicy and finer flavored than the blackberry. Here I believe some experimental work should be done to obtain varieties suited to this section.

The soil requirements of the various groups of raspberries and blackberries, we find, vary a great deal with each group. The dewberry likes a warm sandy loam, while the red raspberry and blackcaps do best on a medium or gravelly loam. The purple canes like a little heavier soil, and the blackberry a medium to heavy loam. For best results they all require a deep, well-drained soil, well supplied with humus, so that a good supply of water will be available at fruiting time. All should be planted on elevated land, the dewberry on the warmer slopes, and the blackberry on the cooler northern slopes. The

land should be thoroughly prepared before setting, remembering that we are planting a fairly permanent crop. It should be well plowed and finely harrowed, never setting on newly turned sod land, witch grass sod, or on land on which water stands.

In preparing the land a good coat of manure should be plowed under, and for subsequent fertilization we must depend on commercial fertilizers and cover crops. The matter of fertilization is one of the most difficult problems to give recommendations on, owing to various conditions of soil, etc., so that only a few general suggestions may be offered. In general, nitrogen or nitrogenous fertilizers should be used very lightly on these fruits. The use of nitrogen and the amounts to use must depend almost entirely on the vigor and growth of the plantation. If there is a lack of growth, or the color of foliage is poor, nitrogen should be used, but if plants are healthy, vigorous and making a good yearly growth, use nitrogen sparingly. The use of an excessive amount of nitrogen gives a very heavy rank growth which is detrimental to the production of fine fruit. A light yearly application of phosphoric acid and potash will, I believe, prove to be of considerable value. Cultivation, however, is of more importance than the heavy use of fertilizers.

The use of lime on very acid soils seems to be of some value for red raspberries, but blackcaps are not usually benefited, and blackberries may be injured.

Now let us consider the very important subject of varieties. Here, we find, is a most difficult problem to select from a catalogue varieties which may prove to be adapted to our section, more especially since most of the nurseries are located outside of the State, and, to complicate the situation still more, we find that many new varieties of reds and purple canes have been introduced in late years. These as yet have not been tested to any great extent, either by growers or our experiment station, so that I believe the best indication in the choice of varieties is to find what varieties are now proving to be a success in your section. Plant those and also try a few of the new varieties in a small way. In the case of the blackberry we do not find as many new varieties.

Some of the good varieties of these fruits are as follows: —

Red Raspberries.

Cuthbert: old standard variety of fine quality.
Herbert: a very large, hardy variety originated in Canada.
June: a fine berry; origin, Geneva Experiment Station, New York.
Perfection: a large, bright red, firm berry, hardy; only fair in quality.
Empire: a large, firm, bright red berry, productive, early; origin, Marlboro, N. Y.
Golden Queen: yellow variety, very sweet.
St. Regis or Ranere: fall bearing, fair quality.

Purple Canes.

Columbian: New York origin, very hardy, berries large but soft.
Royal Purple: season late, very productive, berries large and firm.
Cardinal: very hardy, productive, with large but rather soft berries.

Black Caps.

Plum Farmer: Ohio origin, very hardy, withstands drought, berries large, firm, season early.
Cumberland: Pennsylvania origin, usually hardy, berries very large and firm, midseason.
Pearl: Missouri origin, hardy, looks promising.

Blackberries.

Snyder: old reliable, hardy, fruit small, midseason.
Agawam: hardy, very productive, season medium early.
Eldorado: hardy, fruit large, sweet, season medium early.

Dewberries.

Lucretia: berries large, long, very black and attractive.
McDonald: should be tried.

There are, however, some varieties of blackberries which are not adapted to this section of the country, such as the loganberry, Himalaya blackberry, etc.

Having now decided on our list of varieties, we are ready to obtain our plants, and here, I believe, we often make some serious mistakes. Unfortunately, raspberries and blackberries are subject to certain very serious diseases, such as root gall on the red varieties, anthracnose on the blackcaps, rust on the blackberries, etc., which cannot be easily controlled by spraying. This, then, becomes a serious problem, because if these

diseases once get a good foothold they will quickly put one out of business. Thus it is absolutely essential at the start that we obtain clean, healthy, vigorous stock. Such raspberry stock may be obtained from reliable nursery concerns, or, better still, direct from the growers. However, in regard to blackberry stock we are not quite as fortunate. To be sure, blackberry stock can be obtained, but to get good vigorous stock, true to name and free from disease, is another matter, and right here, I believe, is one of the greatest dangers to the future of blackberry growing, — the way in which blackberry stock is being produced. To-day it is almost impossible to find a nurseryman propagating blackberry stock; in fact, the majority of the stock is produced on berry farms. Here in many cases the plants are taken from the sides of the fruiting rows, without particular regard to disease, age of plantation, etc. We all appreciate that this is not the best way of obtaining plants, and the longer this practice is carried on the more our varieties of blackberries are going to degenerate, and I firmly believe that that is the cause of more than half of the poor results with the blackberry to-day. Here, I believe, is a need for some one to propagate the blackberry, producing fine, healthy, vigorous stock true to names, etc. Not only should this be done to improve the growing of the blackberry, but experimental work, on testing and originating new varieties, suited to our conditions should be taken up.

Further, it is not a wise policy under present conditions to buy large quantities of raspberry and blackberry stock to set direct into your fruiting fields. The chances of introducing diseases are too great. On the other hand, it is far safer to buy smaller lots of stock, put the same in a nursery or propagating field, and grow your own plants from them. Then if disease develops in your nursery you can much more easily eradicate it without much loss. Other advantages are that you will have the stock on hand, in ideal condition when ready to set, and you can produce the type of plants to give best results. With the red raspberry best results can be obtained by the following method: in the spring, when the new green shoots are coming up, dig them up carefully and set them close together in nursery rows for one year. This will give fine vigor-

ous stock. Then in the following fall or spring this stock is taken up, inspected for disease, and, if found clean, is set in the fruiting fields. Plants of this type will make wonderful growth in one season, and the second season will bear a very heavy crop of fruit. Blackcaps and purple canes, however, are usually propagated by tip layering. Blackberries may be grown either from root cuttings or suckers.

Now, having obtained our plants, we are ready for planting. Reds and blackberries may be either planted in the spring or fall, but blackcaps and dewberries should always be planted in the spring.

The system of planting will vary a great deal with different varieties. The reds are grown both in the hedgerows and hill systems. Some varieties may do better in the hill system, while others give better returns in the hedgerow. For Massachusetts in general the latter is preferable. Blackcaps are grown in hills, and the purple canes in both systems. Blackberries are grown in hedgerows and on wire trellis. Dewberries which creep on the ground the first year are usually tied to stakes or to wires on a trellis the second, or fruiting, season. After fruiting, the old canes are cut away, and the following spring the new canes are tied, this being repeated each year.

After setting, the field should be kept thoroughly cultivated and hoed until late summer, when a cover crop should be sown. This is very important, as it protects the land and plants during the winter, and adds humus to the soil. In the growing of dewberries it is essential that a cover crop or a crop of weeds be allowed to grow to protect the plants over winter. In some sections it may be necessary to protect the red raspberry by laying down and covering. This is rather an expensive process, and I believe we should grow hardier varieties and correct other conditions to prevent, if possible, winter killing, by giving considerable attention to the location of the plantation, soil moisture, cover crops and windbreaks.

The latter is very important, as heavy drying winds during the winter and early spring have a great deal to do with the loss of plants by winter injury. Pruning, then, becomes a very important operation in growing these fruits, owing to the fact that the fruit is borne on new canes each season. Thus each

spring they should be thoroughly pruned, cutting out old dead or diseased canes and small weak shoots, and if plants are very thick they should be thinned some; also cut back the tops about one-third each year.

Having now produced our crop, we find that harvesting becomes a most important problem, for a great deal depends on our success at harvesting whether or not the undertaking will show a profit or loss. Raspberries and blackberries are fruits which to be at their best must be picked at just the right time; at the same time, they must be picked carefully and moved rapidly. Never leave the boxes of fruit in the sun, handle roughly or store in a damp place, remembering always that these fruits are very delicate, delicious when in prime condition, but of no value if over ripe or moldy, etc.

Yields and profits of these fruits will vary a great deal, but with present prices and average yields of 3,000 to 4,000 pints of red raspberries, 3,000 to 5,000 pints of blackcaps, and 2,000 to 3,000 quarts of blackberries per acre, we may be assured of good returns.

In closing I believe we should give more attention to the growing of these fruits in Massachusetts. The experiment stations and others should test new varieties to find those best adapted to our State, and also carry on experimental work in producing new varieties which will better suit our conditions, and propagate stock, so that clean, healthy, true-to-name stock will be available and encourage in other ways the growing of raspberries and blackberries. Then and then only will this industry flourish, and we will be able to supply the tremendous demand for these fruits.

The testing of varieties and the production of stock has already been started in a small way in this State, and I believe with this start already made, a bright future awaits those who are interested in growing these fruits.

Mr. Cook. I would like to ask if among the purple canes there are good red berries.

Mr. Davenport. In the case of the new purple canes, varieties that are being originated, there is more or less variation in the color. Most people object to the varieties of purple

cane berries to-day, saying that they are not attractive in appearance. The public in general in buying those berries are not attracted at first by the appearance, and I think you will find inside of a very few years the purple canes, or some of the purple cane varieties that are being put on the market, will be almost entirely different in color than the ones we have at the present time. In the experimental work that is being carried on in the crossing of various varieties for the purpose of obtaining these purple canes they have been using all kinds and types of raspberries, not only the American Reds but European Reds, some of the ornamental varieties of raspberries, the blackcaps, and all kinds and types of raspberries they have been able to determine, so I am sure we will find the development may be such that in a few years the purple canes or the newer varieties, or some of them at least, will be much more attractive in color than those we have at present.

Mr. Williams. Would you recommend setting out the Columbian?

Mr. Davenport. I believe the Columbian to-day is one of our safest purple canes to start off. It is an extremely hardy variety and extremely productive.

Mr. Williams. You prefer that to the red Marlboro?

Mr. Davenport. Yes, I think so, at the present time.

Mr. Williams. For the same reason?

Mr. Davenport. Yes, sir, a good deal the same reasons.

A Member. How late can you cultivate in the summer? What is the best cover crop?

Mr. Davenport. In the matter of lateness of cultivation, that varies, and it depends almost entirely on the season. If it is extremely dry there is no particular object in putting in a cover crop, and we keep on cultivating until conditions are a little more favorable. We like, however, to start the latter part of July to give one or two cultivations after the crop is harvested, and then sow a cover crop. The cover crops we plant in some cases are buckwheat, in some cases barley or oats, and in other cases some nitrous cover crop. We, however, depend entirely on the soil conditions and what cover crop will do well in that soil. And speaking about cultivation and other things, many people have advocated that during the

picking season of the red raspberry we ought to discontinue cultivation. I believe we ought to increase our cultivation during the harvest season rather than cut down on the cultivation. The more the pickers walk through the field the more they tramp down the surface of the soil. The more they tramp down the surface of the soil the heavier the evaporation. At that season of the year the rainfall is apt to be light, and in order to bring through a good crop it is absolutely necessary and essential that we have a good supply of moisture, and we can hold the moisture we have there by more frequent cultivation.

Chairman Munson. Any other questions?

A Member. Wouldn't mulching answer the same purpose?

Mr. Davenport. Mulching during the fruiting season? Yes, mulching during the fruiting season would serve the same purpose. It can be done in a small way where there is only a small amount to be done, but cannot be done very well commercially. In the case of winter conditions, I believe it would be cheaper to grow a cover crop than to try a mulch. In many sections, particularly in the case of the dewberry, their mulch is practically always weeds. Usually from the middle of July they let the weeds grow, serving as a cover crop and mulching the land.

A Member. I suppose that is a matter of cost, isn't it?

Mr. Davenport. Yes. I rather think in the case of the dewberry we might, if we gave it proper protection and planted it on proper soil, be able to obtain fairly good results.

Mr. Van Meter. Do you plow your plantation in the spring?

Mr. Davenport. In regard to the plowing, usually as soon as the land is in workable condition we plow one or two furrows on each side of the row, throwing dirt towards the plants; then a little bit later we start cultivation, depending on soil conditions, and cultivate the soil down level again. I found in some sections, particularly New York State, that there the growers plow towards the plant the first part of the spring; then about two weeks later they go in again and plow the soil back from the plants, before they start cultivation. I do not really see that there is any need or any particular object in

that double plowing. I think by plowing towards the plant the first part of the spring, and then by cultivation, we can keep the land in good condition.

Mr. Williams. What is the distance between the rows?

Mr. Davenport. The distance between the rows, in regard to raspberries, should vary quite a good deal, depending on the particular variety. With some of the smaller growing varieties 5 feet is plenty, whereas with some of the larger and heavier growing varieties we ought to have at least 6 feet.

Mr. Stockwell. May I just say a word? I wouldn't throw any cold water upon what the speaker has said, nothing of the kind, but if you are going to follow the raising of blackberries and raspberries you had better follow the instructions that the speaker has given you very closely. I had two acres of raspberries at one time, and I fertilized very high because I wanted the best thing on earth. I did get a large, handsome growth of plants, but the consequence was nine-tenths of them all died in the winter. I put in an acre of dewberries and they did finely the first year, and next winter they almost entirely died out. Now, you have got to be careful how you handle these things, and you had better follow your instructions pretty closely or you will come to grief.

Mr. Merritt. I would like to ask Mr. Davenport if he knows if the June Red has been tried out to any extent around here.

Mr. Davenport. I do not know for sure. I think probably Mr. Sprague could tell us. Wasn't the June tried at Turner Hill? I am under the impression it was tried there.

Mr. Sprague. Not that I know of.

Mr. Merritt. I have a few, but I am not satisfied with them in this locality.

Mr. Sprague. I tried those myself with indifferent results the last few years.

Mr. Davenport. In Worcester County they tried the June and had good results there. It is a variety used a great deal in the work of crossing and originating new varieties. Under New York conditions I found the June in some sections was a very important variety, grown almost to the exclusion of some of the others.

Mrs. Goodwin. I would like to ask if you know anything about Syracuse Reds.

Mr. Davenport. All I know about the Syracuse Red is that I saw it growing this last year for the first time in one of the nurseries near Rochester, New York. It certainly was liked there. I haven't seen it in a fruit field, but simply in a nursery where they were propagating stock. It shoots up well, the berry is exceptionally good, of fine color and fine size, firm, and is a very attractive appearing berry, and the same applies to the foliage.

Mrs. Goodwin. I had something like fifty-one canes from which I had some 50 quarts of berries this last year, and won the prize here at the hall, and it proved to be a very firm, very large and very beautiful berry, and held up well.

Mr. Cook. I would like to inquire about the Gibraltar blackcap.

Mr. Davenport. That is a new one on me.

Mr. Cook. King Brothers had a nursery of it, and it proved very satisfactory. Forty years ago blackcap was one of the most productive. I noticed last year in Worcester that the blackcap sold equally as well as the red raspberry, so our blackcap is coming back again.

A Member [from New York]. Relative to the June, it has been one of the most satisfactory breeds I have grown. It is very early, of a good size and a very attractive color. It is subject to yellow leaf, a rather obscure trouble in New York State, which almost all of our commercial reds seem to be subject to, yet it is about as promising as any. The Ontario also looked very good.

The Commonwealth of Massachusetts
DEPARTMENT OF AGRICULTURE
ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 19
March, 1920

MARKETING APPLES

D. T. DODD

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

3-'20-2,500

THE BEST SYSTEM OF MARKETING APPLES.

D. T. DODD, HUDSON, MASSACHUSETTS.

In order to be a successful fruit grower it is necessary not only to be able to grow high quality fruit, but also to market the fruit in such a way that the net returns may be the largest possible. Like all producers, the fruit grower's problem is how to get the greatest proportion of the consumer's dollar. In Massachusetts the problem of marketing fruit is far different from that which confronts the western grower. Here we have the best markets in the world at our very doors, while the western growers must transport their fruit many thousands of miles to these same markets. The market being far away, the western fruit grower has found that the only successful way to compete with the eastern grower is by co-operating and selling his fruit through an exchange. By this means he gets a uniform standard of grades, a uniform pack and a very high standard grade of fruit. As the fruit is all pooled together and shipped and sold by trained men, the individual grower has the marketing of his fruit taken out of his hands, and can devote all his attention to the growing end of the business. Here in Massachusetts, more particularly so in the eastern part of the State, the individual grower must work out his marketing problem in his own way. As we each have our own methods, no one of which is perfect, we can all profit by finding out our neighbors' successes and failures. In the rest of this article I will describe how I have worked out my marketing problem.

My fruit is sold in two ways, — through commission men in Boston, and direct to the consumer on a roadside stand situated on the main automobile highway from Boston to Worcester. My orchard is located in Hudson about 30 miles from Boston, the stand being about 3 miles from the orchard.

Before discussing these two types of market, I will briefly describe the method of handling the fruit from its arrival in the packing house until it is ready for shipment. The fruit is brought in the left-hand door of the packing house and is piled beside the grader, which is directly opposite this door. The type of grader used is the Pease Perfect grader, which will separate the fruit into four sizes. The grader should really be called a sizer, as no machine can separate perfect fruit from imperfect. The smaller apples fall into a tin shoot under which a box is placed. The rest of the fruit drops into three trays, according to the size of the apple. From these trays it is taken out by hand and put into boxes, the well-colored, perfect and nearly perfect apples being separated from the imperfect or badly blemished apples. By this method the fruit is divided into four sizes, all but the smaller size being graded. The three graded sizes are brought across the packing room and put on the packing bench, each size being stacked separately. The smallest grade is taken to a sorting table and divided by hand into two sizes, the poor apples being thrown out. The imperfect apples from the three trays are also brought to the sorting table and all very bad apples, such as (1) badly mishapen, (2) wormy or partially rotten, are thrown out. On this table the boxes have risers, so that they can be filled full of apples. When the boxes are filled, they are slatted and stenciled and piled up near the right-hand or shipping door, ready for shipment.

In grading the apples by machine the work is done by three men. One turns the machine and keeps it supplied with apples, while the other two men do the actual hand grading. On an average, 20 boxes are run through the grader in an hour. As each man is paid 50 cents per hour, the cost of grading by machine is found to be $7\frac{1}{2}$ cents per bushel.

The three best grades when sold on commission in Boston are packed in layers in the bushel box, great care being taken that the bottom layer is as good as the top. The fruit sold in this way is all put in the Boston market gardener's box, and as it is all sent to market by automobiles, it is sent as an open package. One man does the entire packing. He averages six boxes an hour, and as he is paid 50 cents per hour the cost of

packing is found to be $8\frac{1}{3}$ cents per bushel box. All dropped apples and all other grades are sent in the loose pack, simply being graded.

The packages used are the Boston bushel box for the wholesale trade, and a 4-quart basket and the bushel box for the retail trade. The cost of the box is 23 cents delivered in the packing house. To this must be added the cost of four risers and two slats, and the labor of putting them on. This makes the total cost of the box 25 cents. In selling on commission 15 cents is returned to the grower for the box, making his net loss on the box 10 cents. The cost of the 4-quart basket is 7 cents at the packing house.

The varieties sold are Red Astrachan, Gravensteins, Wealthy and McIntosh. The following are the amounts of each kind sold on commission this year: Red Astrachans, 287 bushels; Gravensteins, 245 bushels; Wealthy, 126 bushels; and McIntosh, 372 bushels, a total of 1,030 bushels sold on commission. The fruit sold on commission in Boston is all hauled from the packing house by automobile truck. By this means the fruit can be shipped in open packages; it arrives on the market in perfect condition, and by leaving here in the evening arrives on time for the opening of the market. The cost of hauling is 21 cents per bushel. The fruit is sent to two commission houses, one on each side of the market. By this means there is keen competition between them to get the highest prices.

Each box is stenciled with the name of the variety, the grade and the commission house. It is also stenciled, "Packed by D. T. Dodd, Hudson, Massachusetts." The fruit being marketed in this way for the last four years has now won a very good reputation, so that top prices are obtained on all grades. Purchasers have learned that the fruit is uniform throughout the box, and that they can depend absolutely upon finding the lower layers fully equal to the top layer. Many are content to order, simply by asking for the grade desired, knowing that they can depend absolutely upon the honesty of the packing. I attribute the good prices obtained to my invariable adherence to this practice.

Best Red Astrachans brought $6.50 and $6 per bushel, and the best grade of the other varieties, $5.50 per bushel. The

net returns on the 1,030 bushels sold was $3,320, and the average net return per bushel was $3.23. The cost of selling was 10 per cent of the selling price.

The stand is operated by the Highland Co-operative Fruit Exchange. The members are a group of 25 farmers, living in Marlborough and Hudson. The stand is located about a mile from Marlborough, on the main Boston & Worcester road. It is run and managed by the manager of the exchange. Only products grown by the members are sold on the stand. Each grower pays 12 per cent on his products sold. The exchange is a stock company, so that if it proves a success, each member will benefit from the dividends. The policy of the exchange is to give the buying public an opportunity to buy fresh farm products at less than the retail price in the cities. We do not believe in profiteering, but by charging fair prices expect our patrons to become steady customers. This policy has already proved its value, as we now have many regular customers who buy every week or so. A satisfied customer will tell his friends about us, so that we are constantly increasing our regular trade.

Apples are sold by the basket and by the bushel, peck or quart. Fancy apples can also be bought singly or by the dozen. All the apples, except those in the basket, are weighed out and sold in paper bags, unless the purchaser takes a whole bushel, when an additional charge of 25 cents is made for the box. The exchange furnishes the paper bags, so that the grower has no additional expense for containers, except for the baskets. When sold in baskets the fruit is sold at a high enough price to cover the expense of the container.

From this orchard the same varieties have been sold on the stand as on the Boston market. In computing the number of bushels sold, 8 baskets or 150 single apples are figured as equal to 1 bushel. The following are the amounts of each kind sold on the stand: Red Astrachans, 108 bushels; Gravensteins, 34 bushels; Wealthy, 20 bushels; and McIntosh, 261 bushels. The cost of grading is the same whether sold on commission or on the stand. I have done my own hauling to the stand, using a Ford truck. It is impossible to figure the exact cost of hauling, as many times only a partial load is hauled. However,

as the distance for the round trip is 6 miles, which can be covered in forty minutes, allowing for the time of unloading, the cost of hauling is considerably less than it is for the 60-mile trip to Boston and return. To get at an approximate figure, the cost of each trip may be figured as 30 cents for running expenses, and 34 cents for the driver or a total of 64 cents. On an average, 10 bushels are sent on each load, making a cost of 6.4 cents per bushel for hauling.

Each grower, after consulting with the manager, puts his own price on his products. As a result, the price for the same grade of apples from different farms is not uniform. However, this arrangement has worked very well, as the grower putting up the best pack at the lowest price will far outsell his fellow growers.

The net returns on the apples sold on the stand by me was $1,119.53, making a net return per bushel of $2.65. As already stated, the net return per bushel on the apples sold on commission was $3.23. The reason for this difference is that on the stand the demand for my apples was largely for either dropped apples or the cheaper grades of hand-picked apples, thus leaving the best grades to be sold on commission.

Next year the stand will probably increase its business many times; as this was its first year many experiments had to be tried, some proving profitable and others failures. One of our best experiments was that of having an advertising display on the main stand on Sundays and holidays. The display consisted of either packed boxes or flats of fancy apples put up on an incline. The display was put up early in the morning, the main object being to attract the attention of the passersby. On Sundays and holidays a large proportion of the automobilists are out simply for a trip. In passing the stand in the morning they would be attracted by the display, and would either stop then and buy, or, what was more often the case, stop on their way home in the afternoon. During the morning the display was not for sale, but by the middle of the afternoon it had served its purpose as an attraction and could be bought in box lots.

The Commonwealth of Massachusetts

DEPARTMENT OF AGRICULTURE

ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 20

March, 1920

SPRAYING

H. H. WHETZEL

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

3-20-2,700

SPRAYING.

H. H. WHETZEL, PROFESSOR OF PLANT PATHOLOGY,
CORNELL UNIVERSITY, ITHACA, NEW YORK.

There are four fundamental principles upon which all methods for controlling plant diseases are based, namely, *exclusion, eradication, protection* and *immunization*.

It is upon the first of these, exclusion, that all quarantine and similar exclusionary methods and measures are based. The United States quarantine act of 1912, together with its numerous amendments, the rules based thereon and quarantines laid thereunder by the Federal Horticultural Board constitute the most extensive application of this principle ever undertaken. Upon the soundness of exclusion as a fundamental principle in disease control there can be no question; upon the practicability or advisability of its application for the exclusion of foreign pathogenes and pests from this country under modern conditions of commerce and transportation, there is abundant ground for honest difference of opinion which only trials and time can settle.

Eradication of pests and pathogenes which have become established in crop areas of larger or smaller extent has been applied in this country during the last decade on an extensive scale in a number of notable cases, as, for example, the chestnut blight, the white pine blister rust, the citrus canker, and several insect pests. Remarkable success is claimed in a number of these cases, while in others equally notable failure is admitted. The eradication of certain disease-inducing fungi, such as grain smut, the potato scab organism, etc., from limited areas has long been regarded a successful practice.

Protection of crops from the attacks of fungi and insects by the interposition of some sort of barrier is perhaps the oldest and most widely applied of these four principles of control. It is upon this principle that spraying is based. Spraying is, in most cases, a method of protection. It has been for nearly four decades the chief weapon of the fruit grower in combating the insects and fungi that attack his crops.

Immunization, the development of immune or highly resistant strains or varieties of cultivated crops, has but recently received the practical consideration which its promise of profitable application has warranted from the first. The perennial nature of the crops of the fruit grower makes its application to their problems of less immediate promise than in the case of the annual crops of the cereal or field crop farmer.

Our attention, therefore, to-day will be directed to a consideration of the principle of protection and more specifically to spraying as a method based upon this principle.

Definition.

Spraying consists in the application of fungicides and insecticides in liquid form for the protection of our fruit crops. While, in general, spraying is to be looked upon as a method of protection, it is in a few cases a distinctly eradication method as, for example, in the case of the control of peach leaf curl or San José scale. We shall, however, confine ourselves to-day chiefly to its applications in the control of scab and codling moth of apples and the brown rot and curculio of the peach.

History.

A brief consideration of the history of spraying, particularly in the United States, will afford a desirable background for a better understanding of the practice as now in vogue in this country.

Spraying, as a measure for protection against pests and diseases of plants, may be said to have been introduced into the United States about 1885. Following the discovery of Bordeaux mixture by that noted Frenchman Millardet, in France in 1883, the mixture was almost immediately tried

out in this country for the black rot of grapes, the apple scab and the late blight of potatoes. The results were so satisfactory that within a decade it had become the generally recommended and accepted fungicide for most of the fungous diseases of our crops. It continued to hold this pre-eminent position until about 1906, when, through a discovery by Cordley in Oregon, lime-sulfur was introduced as a substitute for Bordeaux in the summer spraying of apples. The work of Wallace in New York during the years 1909 to 1912 on the control of apple scab by the use of lime-sulfur brought about the all but complete abandonment of Bordeaux as a fungicide for apple scab in that State. Work in the other apple-growing sections of northeastern United States, Canada and the Pacific Coast completely confirmed the results obtained in New York, so that within five years lime-sulfur had largely replaced Bordeaux as a summer spray for apples in most apple-growing regions in the United States and Canada.

It is interesting to observe in passing that experimental work on spraying as a field practice in the control of plant diseases and pests in this country was at first almost entirely in the hands of horticulturists. The reasons for this are not far to seek. Plant pathologists as such were few and their efforts were largely confined to investigational work in the laboratory. They were busy with studies on the nature and life history of the organisms that caused these diseases. Horticulturists were far more numerous and were, from the nature of their work, most closely associated with the grower in the practical problems in the orchards and fields. Disease and pest control was looked upon as a practical problem rather than a scientific one. Plant pathology as a profession had little or no standing, while horticulture was generally recognized as the most advanced and progressive of agricultural professions.

The decade from 1900 to 1910 saw the entrance of the practical plant pathologist into the agricultural field in this country. The first university chair of plant pathology was established in America in 1907. Before the end of the decade plant pathologists as such were appointed to positions in many of the agricultural colleges and experiment stations in this country. Immediately they began to claim their rightful place in agri-

cultural teaching and practice. They rapidly took from the horticulturist those functions and problems to which their professional training and obligations justly entitled them. The process of transferring the plant disease and insect pest work, especially their practical applications, from the horticulturist to the plant pathologist and entomologist is still going on. Another decade will see it completed. This division of labor and differentiation or specialization has had its usual reward in a phenomenal progress in disease and pest control. America, to-day, is twenty-five years in advance of Europe in the science and practice of plant disease control. The day of the professional plant doctor is at hand. Already the progressive farmers and fruit growers are bidding against the agricultural institution of the country for the services of the professional plant pathologists. They are buying their services with their own hard cash, and the institutions must look to their salaries if they expect to retain for State and Federal service the best men in the profession.

What constitutes a Good Fungicide.

A fungicide is a substance which properly and timely applied to susceptible parts of the living plant will protect it from the attacks of pathogenic organisms.

The requirements of a good fungicide are effectiveness against the pathogene to be controlled, safety to the plant to which applied and adhesiveness. As corollaries to these fundamental requirements are to be noted cheapness, ease of application, and miscibility with insecticides.

With the introduction and development of Bordeaux mixture, copper became the all but universal active agent in fungicides. Bordeaux meets the above requirements of an acceptable fungicide to a remarkable degree. Copper is probably the most active fungicidal agent yet discovered. Combined with calcium in the form of a colloid known as Bordeaux mixture, it possesses a degree of adhesiveness as yet unsurpassed. Its injurious action on the living tissues of many plants, especially apples, peaches, plums and cherries, has led, however, to a persistent search for substitutes. Among the substances pro-

posed from time to time to take the place of copper, none has been found to so generally meet the requirements as sulfur. Known and used as a fungicide long before the introduction of copper sulphate, it was almost entirely discarded upon the discovery of Bordeaux mixture. With the gradual appreciation of the injurious action of the copper in Bordeaux upon the fruit and foliage of the apple, and its early recognized unsafety on the leaves of stone fruits, came the demand for a safer substitute in the spraying of these fruits. With Cordley's discovery of the efficiency and safety of lime-sulfur as a substitute for Bordeaux on apples and Scott's development of the self-boiled lime-sulfur for peaches, the fallacy of a universal fungicide was at last definitely recognized. To-day, we accept the fact that both copper and sulfur have a distinct place in plant medicine, and other substances promise to find a place in plant prophylaxis.

Relation of Fungicides to Insecticides.

In the development and applications of a fungicide, one of the chief problems which the pathologist has to meet is its combination with insecticides. Modern agricultural practice requires a rigid economy in operation. The cost of labor and the requirements of timeliness in application demand that in most cases fungicide and insecticide shall go on to the crop in the same operation.

Arsenic in some form continues to be the chief agent in the killing of chewing insects. Nothing has yet proved so effective as nicotine for contact killing of sucking bugs, such as aphis, red bug, psylla and the like. A practical fungicide must therefore be subject to safe and effective combination with insecticides in which both arsenic and nicotine in some form are to be used. Happily, both Bordeaux and lime-sulfur have qualified in this respect to a remarkable degree. Wallace has shown that the fungicidal value of lime-sulfur is even increased by combination with arsenate of lead, without any evident decrease in safety to either. Nicotine sulfate, sold under the trade name of Black Leaf 40, has likewise proved a safe and efficient contact insecticide in combination with both Bordeaux and lime-sulfur.

It is evident, therefore, that we have in our present standard fungicides and insecticides that fortunate compatibility so requisite for practical and efficient use in meeting the problems of disease and pest control.

Modern Spraying Machinery.

While the discovery and development of safe and effective fungicides and insecticides have been fundamental to the present-day methods of plant protection, the perfection of machinery with which to apply them has been almost equally important. Bordeaux was first applied with a whisk broom, and the primitive sprayers of the 80's were scarcely more than sprinklers. We regard with amusement and contempt the so-called nozzles through which our fathers squirted Bordeaux and paris green. The knapsack and barrel hand-pump sprayer have been almost entirely replaced by the handy compressed-air sprayers and engine-driven orchard outfits. The mechanical genius of the manufacturers has given us an annual crop of improved nozzles, the most modern development of which is the spray gun. Once satisfied with a pressure of 25 to 50 pounds, we now demand 200 to 300 to get that fine driving mist so generally recognized as essential to effective application. The development of the spray gun was a direct reply to the demand for greater rapidity and conservation of labor in our spraying operations. Speed in operation has been obtained, however, at the sacrifice of certain essentials in application. A greatly increased wastage of spray materials has undoubtedly resulted where spray guns have replaced the pole and angle nozzle. Inferior control or distribution of material over the leaf surface, especially in large trees, unquestionably occurs, with the result that only the lower branches are thoroughly covered, while the attempt to reach the higher parts of the trees has resulted in frequent and serious foliage injury due to drenching of the leaves below. In spite of the claims that the solid stream from the gun will break into a fine mist in the tops of tall trees, an examination of the foliage there, and the poor control of scab and worms frequently to be observed on the higher branches, does not bear out these claims. If one is to judge from the frequent comment of gun

users during the past season, a general return to the slower but more efficient pole and nozzle equipment is setting in. There is no question that under certain conditions, for certain purposes, and in the hands of competent operators the gun has proved a rapid and efficient spraying weapon. But for general orchard spraying and in the hands of the unskilled labor at present available for the work, it is less satisfactory than the best angle nozzle at the end of a 10 to 14 foot pole. Had the tower and double lead of hose been retained, the advent of the spray gun would undoubtedly have proved much less of a disappointment.

Timely Application.

Probably no feature of successful spraying is less understood and appreciated by the average grower than timeliness of application. In spite of accumulating evidence and the persistent teaching of plant pathologists during the past ten years, growers have failed to fully appreciate or have not understood the absolute necessity of getting the spray mixtures on at just the right time. This factor more than any other conditions success or failure of spraying operations. "Spray just before the rains, not after" has been shouted at you from platform and printed page. The deeply rooted notion that rains will wash off the fungicide or poison has been completely disproved and exploded. It has been repeatedly shown that for any given successful application usually not to exceed two or three days are available. Yet in spite of the fact that every intelligent grower knows that not more than 4 acres of full-grown apple trees on the average can be properly sprayed in a day, almost none of you have a sufficient number of spray rigs available to cover your plantings in the period available for successful operation. There are still many growers who spray when most convenient, thereby often missing the most effective time for doing the work. A not inconsiderable number try to beat the game by spraying almost continuously throughout the season with the result that they waste most of their time, labor and materials. A few growers have begun to appreciate the absolute necessity for timeliness in application and have sought to meet the situation by doubling or trebling their equipment,

but the high cost of machinery and labor has made the expense of such measures increasingly prohibitive. Very recently growers have begun to look with hope to dusting as a means of meeting the situation, but for the great mass of our fruit growers a lack of understanding or appreciation of the factor of timeliness constitutes the chief cause of failure to control diseases and pests where spraying is carried out.

Dusting to Replace Spraying.

Of the many problems pressing us for further study and investigation, none is more urgent than that of dusting. Prior to the war we carried out in New York State an extensive series of investigations on the relative efficiency of dusting in comparison with spraying for the control of apple scab and codling moth. Our results showed dusting to be equally effective against these two pests. Experiments since that time in other apple-growing regions, notably Michigan, Illinois and Nova Scotia, have given results in general accord with the results we obtained. But dusting, as a general practice, has made slow progress, due to certain limitations which, however, promise early solution. Among the chief drawbacks to its general adoption by our fruit growers has been the lack of an effective contact dust for sucking insects, like aphis, psylla and red bug. Preliminary experiments, especially in California and Nova Scotia, promise an effective nicotine dust in the near future. Improvements in dusting machinery, cheapening of dusting materials, and a better understanding of the factors conditioning effective application are pressing for attention.

Replying to a questionnaire sent last November to duster owners in New York State, 73 replied that they had dusted apples last season. Of these, 49 reported as good or better control of scab by dusting than by spraying; 51 reported codling moth as well or better controlled; and 68 (over 93 per cent) report that they will dust apples again next season. Even larger percentages replied in favor of dusting peaches and cherries.

The results obtained this past season in Nova Scotia, both in the experimental plots and in commercial orchards, were so

uniformly successful with dusting that its substitution for spraying will undoubtedly take place there as fast as the growers can change machinery.

With the cost of spray materials and machinery almost uniformly high, it is significant that dusting materials promise to be generally cheaper this next season than they were last and the demand for dusting machinery threatens to exceed the possible supply.

Dusting has so many promising and profitable features, especially as a saver of valuable time and labor, that its general adoption cannot long be delayed. The principles upon which it is based are sound; there is no virtue, *per se*, in the application of fungicides in water if the same materials can be applied dry. Professor Sanders of Nova Scotia has developed a new copper-lime dust which gives every promise of efficiency equal to that of the same materials in the form of liquid Bordeaux, and Dr. Brittain of the same province is at work on a nicotine contact dust which in preliminary experiments has given great promise as a killer of the sucking insects. Dry sulfur and arsenate of lead have already proved quite as effective when applied dry as when used in the liquid form.

With the standard fungicides and insecticides all thus available in dry form, there remains only to perfect the methods for their application in order to eliminate entirely the water which now so seriously interferes with rapid and timely operation in the control of our orchard pests and diseases.

The County Spray Service.

Impressed with the paramount importance of timely application in the control of apple scab and other fruit diseases in our New York orchards, we undertook about three years ago the experiment of organizing and directing a so-called spray service in certain of our best fruit counties. Upon request of the Farm Bureau organization a man with good fundamental training in plant pathology and entomology is placed in the county as special field assistant, with headquarters at the Farm Bureau office. The county provides and maintains a Ford for his use. He is assigned to the county about April 1 and re-

mains until about October 1. His job is to work out in co-operation with the county agent a plan for advising and directing the spraying operation of such growers as make request for the service. The extension pathologist and extension entomologist of the college supervise and direct his work. A variety of schemes for notifying the growers have been tried out, but the relay telephone system handled through the Farm Bureau office has usually proved the most satisfactory and efficient. With one eye on the weather map and the other on the development of the buds, the field man determines the proper time for the most effective application and promptly notifies each grower a day or two in advance. The grower is also advised of the proper strength and combination of fungicides and insecticides to be used. A few criterion orchards, scattered at advantageous localities over the county, are sprayed under the personal supervision of the field assistant, and serve to demonstrate the efficiency of the recommendations sent out to the growers.

At first the State paid the entire salary of the field assistant and furnished supervision of his work without expense to the county. Last season six counties maintained such field assistants, providing one-third the man's salary. This coming season at least 8 counties will have a special field assistant on plant disease and insect control and will pay two-thirds the salary, the college providing but one-third. The growers receiving the service provide the funds for meeting the counties' share of the salary in addition to providing the funds for buying and maintaining the car. Besides general supervision by the extension pathologist and entomologist the college will provide (as it did last season) a special supervisor, who, during the growing season, will give all his time to assisting and overseeing the work of the special field assistant.

The positions of field assistant have been almost entirely filled by seniors or graduate students specializing in plant pathology and entomology. They are young men of marked ability but usually with little actual practical experience. That they have met their opportunities and responsibilities is evidenced in the rapidly increasing demand on the part of our growers for their services. The willingness of the growers to

bear an increasingly large proportion of the expenses of such service is a further indication of their confidence in this plan.

In emphasis of the justification and value of this service I can do no better than quote from a recent paper on the subject prepared by Professor C. R. Crosby, our extension entomologist, and G. R. Palmer, one of our most successful field assistants.

It is becoming increasingly apparent that to be most effective demonstration work in the control of insect pests and plant diseases should be conducted for the most part on the basis of a seasonal program of treatment and not by demonstrating the control of any single disease or pest nor by isolated tests of spray materials or methods of application. The object of this kind of demonstration work is to show the value of the approved seasonal program of treatment as adapted to local conditions and to the weather prevalent during the season, and to teach the growers the most effective and economical method of protecting their crops from insect pests and plant diseases. Both from an educational and financial standpoint demonstrations conducted in accordance with the seasonal program are of greater value not only to the individual but also to the county as a whole. Efficiency requires that the work be done with an organized group of growers rather than with individuals. In order to achieve this result it is necessary that sound expert advice be available and that the necessary information be placed in the hands of the growers at the time when it will be of most use to them.

The plan of doing this work by means of field assistants was adopted because our experiences with industrial fellowships financed by associations of farmers had shown that the greatest good can be accomplished in the control of insect pests and plant diseases by having a trained man located in a definite territory where he can become thoroughly acquainted with the local problems, can watch the crops throughout the growing season and by his intimate knowledge of conditions be able to anticipate and prevent destructive outbreaks. He also is able to win the respect and confidence of the farmers as they become familiar with his aims and methods of work. Our experiences have shown that, in general, graduate students, preferably the younger ones, are more efficient and successful in this line of work than are older persons who have become more or less settled in life and consequently opinionated. It has been generally supposed that for this kind of work mature men would be more desirable, but as a matter of fact such is not the case. Where we have been compelled to use older men not actively interested in science or where we have used graduate students who were past the optimum age for study, we have had more misfits and failures than where younger men with more active interest have been employed. This may seem paradoxical. The explanation is that the salary available is not sufficient to attract mature men of sufficient ability. It is much better for the work to employ young men of special ability in their ap-

prenticeship stage than men of mediocre ability who have nothing better in prospect. A young man who in the course of the next ten years is likely to be occupying a $5,000 to $10,000 position is much more valuable for this work than an older man who would be satisfied to take a short-term appointment at $150 a month. The younger men look on this work as an opportunity to obtain first-hand knowledge of field conditions and methods and are therefore willing to spend the summer season for two or three years in this way since it is a part of their training and of direct advantage to them in their life work. Furthermore, thay have an incentive to do their best, since if they make good as field assistants they have a better chance to obtain a good position on receiving the advanced degree; and, moreover, they do not receive a sufficient salary to make them wish to settle down in the work permanently as field assistants.

In western New York, particularly, where the control of apple scab is of the utmost importance, the weather is the vital factor in determining the time at which most sprays must be applied. In this region the work of the field assistants was greatly facilitated by the co-operation of the United States Weather Bureau. A special forecaster was detailed to the Rochester office from April 6 to July 10. Arrangements were made whereby he received from Washington twice daily a special long range forecast, covering the conditions most needed by the service. These forecasts were often modified by the special forecaster. At least one of these forecasts as modified by the forecaster was sent daily to each of the Farm Bureau offices where a special assistant was stationed. A striking illustration of the practical value of these forecasts occurred on May 12, when the forecast indicated that a rain was probable in three or four days. Scab infections had already occurred in considerable numbers in orchards that had not received the delayed dormant spray. A spray warning was issued calling for the application of the blossom pink spray immediately although the blossoms did not yet show pink. The rain began in the afternoon of May 16. Subsequent events showed that this was the critical application for the commercial control of apple scab in western New York this season. In orchards where the application was delayed until after the rain of May 16, 17, the leaves became badly infected with scab and a serious defoliation resulted. Furthermore, in these orchards it was very difficult to keep the fruit free from later infections. Had the special forecast of the Weather Bureau not been available, most of the growers would have waited until the 19th or 20th before making the application, when it was too late to protect the foliage.

During the past season the six assistants we had in the field traveled an aggregate of 34,343 miles, making 3,017 visits, and issued 66 circular letters with a total circulation of 18,207. It is very difficult to estimate the financial return to the growers of the counties concerned, but there is every reason to believe that the increased value of the crops directly resulting from the work would pay several times over the entire cost of the undertaking, including supervision and overhead.

The Community Plant Doctor.

Your attention has been directed in the above quotation to our experience with industrial fellowship laboratories. The work of the field man on an industrial fellowship differs, in two respects at least, from that of the special field assistant. The former has for his primary function that of research or the solution by investigation of problems of pressing importance to the growers. He also performs the function of general advisor or supervisor on disease and pest control applicable to the crops grown by the farmers with whom he works. This, however, is a secondary though very important feature. In the second place his obligations are limited to a much smaller number of growers, usually from 12 to 25. He is the personal or local plant doctor for a very small number of growers, who provide his salary, living expenses while in the field, a laboratory room, and a car for his use in conducting the work. The college provides a complete laboratory equipment and directs his work. The fellow spends the growing season (four to six months) in the field, the remainder of the time at the college in study and investigation looking to his doctor's degree. The fellowship contract is so drawn that the growers may look forward to the services of the same man for a continuous period of from two to four years. The total cost to the growers per year ranges from $1,500 to $2,000. It costs the college an approximately equal amount to equip the laboratory and supervise the work.

During the period from 1909 to 1916, the department of plant pathology at Cornell University had about forty-five such annual fellowships, representing a total investment by our farmers and commercial concerns of some $60,000. During the war, due to a lack of qualified men to fill such positions, the number of fellowships dropped to one, but last year we had three in operation and already requests for a total of eleven such arrangements for next season have been made. Two of these are from small groups of fruit growers. The others are distributed among groups of potato growers, cauliflower growers, market gardeners, truck growers and greenhouse men, and two have been provided by a commercial company for investigations on dusting. Even in the last case the eager co-opera-

tion of farmers is assured to the extent of providing laboratory facilities, orchards, labor and cars for transportation.

This method of solving the plant disease problems of the State has proved highly profitable to the growers. The actual profits in dollars and cents which we are able to show prove this, and the overwhelming demand for more fellowships from many sections of the State indicate the enthusiasm for and the confidence with which the hard headed farmers of New York are turning to scientific methods in solving their plant disease problems.

A Member. I would like to know how you control bitter rot on apples.

Professor Whetzell. Now, before I can answer that question, I must be sure I know what you are talking about. Bitter rot of apples, as the plant doctors know it, isn't a disease of New York and New England. It is a disease of the South. I do not believe you have bitter rot. There was bitter rot in the Hudson valley this year, but I think you mean a Baldwin spot, a little brown spot under the skin, with a depression over it. If you want to call it "bitter," call it bitter pit. If you call it bitter rot, the plant doctor thinks it a disease which occurs in the South. It cannot be controlled by spraying. To explain to you briefly, we think it happens this way: It is a very common disease the world over where apples are grown. It comes only in those seasons where we have had sudden changes from wet to dry some time during the season.

The explanation is this: Suppose you start off with a wet spring. You have a certain amount of root surface developed to feed a certain amount of foliage with water. If the weather suddenly becomes dry, there isn't enough root surface to get far enough to supply the top leaves and the fruit, and the result is either the leaves or the fruit suffers from lack of water.

It is well known that when it is a fight between fruit and leaves, the leaves get it. In other words, water is withdrawn from the fruit to go into the leaves, and you will notice that spot is always worse around the blossom end. It is around the blossom end that the tips of the sap tubes have their opening

to the outside. Naturally, those are farthest away from the water supply, so when the water begins to be pulled away from the current and there isn't water enough to supply the whole apple, the little tips of the sap tubes out around the blossom end and the cells which surround them, have no water.

You get all degrees of injuries, too, from cells that are dead to those more or less injured. You put those apples in storage and not having enough water in the apple, those cells, slightly injured cannot draw it, and they die; and it gets worse and worse until you have large numbers of those spots under the skin, running into the heart of the apple and turning brown, and it dies. That is the explanation given for bitter pit.

The only thing that can be done, as far as I know, is to make every effort to maintain a uniform water supply during the season. If you have a wet spring and dry weather follows, anything you can do in the way of cultivation to ease that drop from much water to a little water and to keep a high amount of water in the soil will tend to reduce the amount of Baldwin spots.

The fewer apples you have on the tree, the more injury there will be. I do not understand it well enough to explain, but that is the general theory. I have never myself carried on investigations on the thing, but there were extensive investigations recorded some few years ago on the disease in Australia, where the disease is bad. The evidence we collected year after year in the State of New York indicates that bitter pit, or Baldwin spot, is the result of sudden changes in the water supply during the season. We never have Baldwin spots in the State of New York when we have a uniformly wet season or uniformly dry season, because then the balance between root and leaf is not disturbed.

Chairman Jenks. A question is asked, is it worse with trees in sod than those in cultivated areas?

Professor Whetzell. I have no data on that. My opinion would be it was likely to be, particularly if the sod pumps the water out. It tends to emphasize the change. It may or may not. It depends on the season, and depends on the conditions in your orchard. Probably in that orchard, if the grass was cut and used as a mulch, you might not get that effect.

A Member. Why do you have a Baldwin spot in one tree and not in another tree?

Professor Whetzell. The only way I can answer that is to ask why does one man get baldheaded and another man doesn't? There is some particular condition respecting that tree. Trees are just as individual as you fellows are. Some of them, because of the particular soil in which they grow, or conditions under which they grow, or their inherited tendencies, or something of that sort, show more Baldwin spots. Just as some of you fellows can wear your hat all the time and not get baldheaded. Others can't wear it at all. You will get baldheaded, anyway.

A Member. I would like to ask Professor Whetzell if he thought he could control apple scab just as well by dusting as he could by the liquid spray. I have often found the liquid spray in the pink stage is just as important as the spray after the blossoms fall.

Professor Whetzell. In New York State it is more important.

A Member. How can you get dust on the pink stage?

Professor Whetzell. Just as well as on the calyx.

A Member. Is it as effective on the McIntosh where they are subject to apple scab?

Professor Whetzell. Taking the averages of the experimental dusting work done in New York, Illinois, Michigan and Nova Scotia, taking the average of the work going on since 1912, — I do not know how many total years that would be for all of them, — but taking those averages, as I took them last week, I found on the average the difference between dusted and sprayed trees, so far as scab control was concerned, did not vary more than 3 or 4 per cent, which is within the range of experimental error. Now that you talk specifically on that particular variety, I do not recall the varieties that were involved, but I do recall that in a number of these cases we had as high as 95 per cent or more of scabby fruit on the checks, and reduced it to 85 to 90 per cent on the dusted. Does that answer the question?

A Member. Do you advocate dusting under any conditions when the trees are in blossom?

Professor WHETZELL. No, it isn't necessary, any more than I would advocate spraying. Now, so far as injury to the fruit is concerned, there is no evidence that spraying or dusting when the trees are in blossom will injure the set of fruit. No evidence, no experimental evidence, as far as I know. The bee men are very certain it kills the bees if you spray or dust when the trees are in blossom. We have dusted trees experimentally in blossom, and we have sprayed trees experimentally in blossom. There is, as far as I know, no experimental evidence to show that spraying or dusting kills bees. I once went over the matter with a professor who made a very careful search for evidence on that point, and he said there was none. I do not say it doesn't kill bees. I do not know. But I say, as far as the experimental evidence goes, there is absolutely none to show it injures the bees and none to show it injures the set of fruit.

A MEMBER. That is the reason I asked that question. Formerly I used to make more than $1,000 on bees. Last year I lost $100. A man there locally will spray his trees many times. He knows better. There is no law against him. He sprays with a weak solution, and he claims it doesn't kill the bees, but the whole hive will dwindle down when the poison has been used in that way.

Professor WHETZELL. As far as I know, there is no carefully carried out experiment on that subject to prove it, one way or the other, but the point is, it isn't necessary to spray when the trees are in blossom. There is no particular point in doing it. There may be once in a good many years such weather conditions where it would be profitable to catch the trees when they are in blossom. In other words, the trees usually blossom during a rainless period. At least, the blossoms open when the sun shines. He should have it ahead of the rain. If a man sprays his trees properly with respect to weather, there is practically never any occasion to spray when they are in blossom; therefore, he and the bee man can live happily without arguing the question. They don't need to even discuss the question, because they don't have to spray when they are in blossom.

Chairman JENKS. The question is asked if you know of satisfactory means of controlling pear psylla.

Professor WHETZELL. That is out of my line. That is a bug question, and I wouldn't offer you any opinion on it.

Chairman JENKS. Can you tell us what is the general practice in New York, where they grow so many pears?

Professor WHETZELL. I never tell anything about bugs. I can't forget my line.

Chairman JENKS. The question is asked relative to dry lime-sulfur, and its merits.

Professor WHETZELL. We have carried on no investigations in the State of New York on the use of dry lime-sulfur. We had one or two demonstrations carried out by the Farm Bureau, and I think this is the general status at the present time in connection with the dry lime-sulfur. I am quoting Professor Parrott, who, while he is a bug man, has also launched into some of the things from the other side. As far as fungous diseases are concerned, if enough dry lime-sulfur is used in the solution, it will be just as effective as the liquid, because it is the same thing, but, as ordinarily sold and recommended, the dilution is too weak. I believe Professor Parrott said to our men last year that 23 to 25 pounds per 50 gallons should be used to give the same result you would get with 1 to 8, of commercial lime-sulfur liquid, or something of that sort, for scale. Then you diluted accordingly to get 1 to 40.

A MEMBER. Professor, do you expect that dusting would be as effective as spraying in a season when there is much wind? I mean particularly after the spray has been applied. Say you get up in the morning and get the dust on before the wind came. Would it be possible, if the leaves were dry, that the dust would be blown off?

Professor WHETZELL. I will answer you by an experience of your own. You drive a car? Yes? You wash it sometimes? No? Never wash it? Well, I can't help you. Well, you have seen fellows wash their car. Yes, nice and clean and shiny. Then they drive it through a dusty road, and then they come in and turn the hose on and soak it with water to wash it off, but the dust was still there when they got done. They had to take a rag and wipe it off. If you can't wash it off with a hose, it isn't likely any wind that blows in New England would blow it off. It doesn't blow off. The finely ground sulfur sticks

just the same as the same sulfur put on wet. It sticks like dust sticks to furniture or to the carpet, and it will stick just as well, as far as I know, as it will when it is put on wet. So, so far as blowing off is concerned, you do not need to worry about that, unless you have windier blows here than we have in New York State. The question is often raised whether it will wash off, and I give the same illustration.

Chairman Jenks. Can you give us some idea as to the relative costs of spray materials and labor in dust and liquid spraying?

Professor Whetzell. There is no question but what dust materials to-day cost more money than the same materials for spraying, that is, than the spray materials that are used. But that is not the way to figure your relative costs of course. If you figure labor saved and time saved and the value of timeliness, — well, leave out that which is the most valuable point, — the time and labor saved, if you figure those in, counting labor costs and cost of materials, in Nova Scotia this year Professor Saunders found that to dust cost about the same as to spray. I think in the two experiments that he made his figures on, the difference was 10 cents less to dust than it was to spray, per acre, — a small amount.

Now, the relative costs of those methods would depend upon many factors which are not constant. A man who has everything right for spraying — water handy, doesn't take much time to fill, and good engines — can put his spray on cheaper than a man who has all these other troubles.

But taking it by and large this last year, so far as I have been able to get figures — accurate figures — experimentally taken by Professors Saunders and Brittain in Nova Scotia, those figures show that the cost, counting labor and materials, was approximately the same for the two.

Now, then, that was counting the relatively high cost of materials for dusting, but, as I pointed out to you, we are in the experimental stage with dusting, and naturally the stuff costs more money than when it is commercial, so you can save on the cost of apparatus. In other words, we are using a crude machine as compared with sprayers, and the duster will be improved. We will get around to it by and by until we control

the dust. We want to go over our methods and our arrangements, and I want to say that those who will do so will do a better job with less material wasted.

Now, another interesting thing. Professor Saunders developed a Bordeaux dust which promises to be as effective as liquid Bordeaux. He found that where he dusted with this Bordeaux dust on apples and compared with it spraying with Bordeaux, although he put 75 gallons of material on in spraying and only 50 pounds in dusting, that he actually got more copper on the leaf surface by dusting than he did by spraying.

In other words, the actual wastage of copper was less in the dusting than it was in the spraying, a thing nobody suspected. The chemist actually found a higher percentage of copper on dusted trees than he did on sprayed trees, so the actual wastage under present conditions in that orchard where he was using Bordeaux in both cases was less for dusting than for spraying.

Chairman Jenks. What is the smallest acreage you would suggest putting on the dust at its present stage of development?

Professor Whetzell. I would leave that to the individual. I never recommend anything. That is one thing I want you to remember when you go away from here, — Whetzell did not recommend a single thing. I am trying to give you the facts as I have them and my opinion, which you can take for whatever it is worth, but if you go home and buy a duster and it doesn't work, don't look at me.

Chairman Jenks. What do you think of soluble oil as compared with lime-sulfur?

Professor Whetzell. In the first place, soluble oils are used primarily to control insects, scale, and so forth. They are not used as fungicides to any extent. I have no information on it. I have carried on no experiments, and I do not know. The only thing I can imagine soluble oils used for in a fungicide is disinfecting peach trees for curl.

Chairman Jenks. The question is asked how about the sooty blotch on apples?

Professor Whetzell. It can be controlled by any of the spray mixtures you use. You have got to put on a later

application. That means ordinary apple scab sprays won't catch.

Chairman JENKS. Sooty blotch is very bad with us in eastern Massachusetts.

Professor WHETZELL. Sooty blotch is a disease that comes on relatively late, and you have got to get a mixture on ahead of it, and probably a couple of them.

Chairman JENKS. The question is asked, why is it better to spray before rather than after rain?

Professor WHETZELL. Well, for exactly the same reason that it is better to get inoculated for typhoid before you get it than after.

Here is the situation. Take the apple scab. The first infections in the spring are produced in the old leaves of last season that lay on the ground, the scabby foliage of last year, that fell to the ground this year.

Those spores are shot from the old leaves, and then a breeze catches them and carries them to the foliage, but they are only shot out during rains, and they get on to the leaves only during rains, and they germinate, and they go into the leaves during that rainy period.

In other words, to get apple scab infection on your early foliage, you have to have about forty-eight hours of rainy weather, some rain for a period of about forty-eight hours, and you will get infection. The fungus will be inside the leaf. If you have no protection on the foliage, you can go if you want, after the rain is over, and put it on the outside, but the spray mixture does not operate to kill the fungus.

In other words, spraying is a protection.

Now, some of you labor under the delusion that you spray to kill something which is already there. You do not. You put the spray mixture on to protect it from something that is going to come, and that something comes during the rain. Almost all fungi are either put on the leaf in the rain or germinate only during a period when the surface is wet; therefore, you must put protection on ahead and not after.

Any other question?

Chairman JENKS. Is it the opinion, Professor, that it is

almost impossible to do as cheap a job with a spray gun as it is with a spray tower and two rods?

Professor WHETZELL. No, it is possible to do as good a job with the spray gun, in my opinion, but it ordinarily isn't done that way, for the reasons I pointed out. If you have a man on the ground and another one on the tower, on a 10 or 15 foot tower, with a good angle nozzle on the end, you apply so much spray per second, and you cover all parts of the tree, and you do not drench any part of it. If a man is out on the tower with a spray gun, and another man on the ground with a spray gun, and the trees were not so large but what you could shoot this mist into the middle of the tree, you can do just as good a job, and applying so much more mixture per second you have to be on the job constantly. That is what happens. The hired man turns on the gun, and the more stuff he can get out of it, the better it looks to him, and he drenches the trees in spots. I saw an orchard in Nova Scotia sprayed with a spray gun where the fellow shot the tree; he took all the leaves and apples off.

Chairman JENKS. If you were doing the job yourself, and of course wanted to save time and expense, would you be inclined to use the gun or the rod?

Professor WHETZELL. I never had any extensive experience with the gun on my own account, but my own opinion is that I would stick to the pole and get a big angle nozzle on the end of it. I think I would save enough material and do enough better job to warrant me using the pole and nozzle than I would with a spray gun. I have seen some men spraying with a spray gun, especially if the trees were small, and they were up on the wagon, do a pretty good job with it, but I have seen many more men, who opened it wide to get to the top of the tree, do a poor job on the top and drench the trees below. So that in the hands of the ordinary man, the average man, I believe that better work will be done with a pole and nozzle than with a spray gun. That is not saying you can't do good work with a gun.

Chairman JENKS. It is particularly applicable to high trees?

Professor WHETZELL. Particularly so, yes, sir, and particularly applicable to the man who isn't very much interested in

doing it exactly right. You see, you are shooting so much more stuff at a time, your chances of doing damage are much more than where you have a small amount.

Chairman Jenks. I think, friends, we will have to draw this discussion to a close, as the time is gone. I am sure that even though Professor Whetzell did not recommend anything to us, he gave us a whole lot to think about that we will try to put into practice somewhat on our own farms this year.

The Commonwealth of Massachusetts
DEPARTMENT OF AGRICULTURE
ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 21
March, 1920

FRUIT GROWING FOR PROFIT

CHARLES W. MANN

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

3-'20-2,500

FRUIT GROWING FOR PROFIT.

CHARLES W. MANN, METHUEN.

I do not intend to tell you what to do, or how to do it, in the business of growing fruit for profit as I do not wish to give particular advice without personally seeing the locations and conditions, as that savors too much of quackery, — prescribing without seeing the patient, — but I will try to tell you what I have been doing myself in fruit production.

You may remember that I have been a grower of strawberries to the amount of perhaps $40,000 and perhaps half that value of tomatoes, but with the changing conditions of labor and markets, the increasing weediness of the soil and other reasons combining to make the business harder and less profitable, I began in 1910 to set apple trees in the ground previously used for strawberry and tomato growing, the most of which I had reclaimed from rough, rocky pasture and sprout land with some underdraining in the low parts.

Baldwin trees were set 40 feet apart, with early varieties or peaches and pears for fillers, leaving spaces of 20 feet when all set, some in cultivated land and others in grass. I have continued planting until the past season, when I put out one thousand apple trees in my large grass field, and now have growing on the farm several thousand healthy, vigorous trees rapidly coming into bearing. While I enjoyed picking the luscious big berries in the years gone by, I have more pleasure now in gathering the highly flavored, juicy fruit from the trees, and it is easier on knees and back.

In buying trees to plant an orchard, I should prefer well-grown two-year-old stock from reliable nurseries, and can see little to choose between northern and southern grown, though it does seem reasonable to suppose that the former would be more rugged and longer lived. It has been possible in some

years to buy whips, or one-year-old trees, of good stock at very low prices, at 10 cents or less, and I have set them in nursery rows in heavy soil for two or three years, until they are rather oversize, when they can be transplanted to the field with plenty of dirt on the roots, and hardly stop growing. This method saves work in caring for them.

Last spring I told my son, who was then fifteen years old, that I would set one thousand apple trees for him if he would take care of them when I could not, and as he was happy to agree to do so we put them in (about half of them grown for a time in our garden or nursery, and the balance picked up from New York nurseries) any size to be found, mostly very small, as the supply was very limited. Holes were dug as soon as the frost was out, while digging was easy (hardly half the work it would have been when the ground had dried out and hardened), 2 feet across and 15 inches or more deep, over 10 acres or more of our big grass field. The sod was placed one side, the black loam another side, and the yellow loam on another side, and, to be a little extra good to the young trees, we cleaned up the loam from some old hotbeds, quite a number of cords of it, and put a half bushel or so in the bottom of each hole. Digging holes cost 6 cents each and was begun March 12 and all dug in March, something we couldn't do this year with our heavy coat of snow and ice, showing how seasons vary. It is but a few years since I plowed for eighteen days in January on this same land. After this loam was put in, the trees were moved from our nursery, and set the first week in April. The dark loam was thrown in first, then the sod reversed and well trod, and last the yellow loam.

After writing, telegraphing and finally telephoning to western New York nurseries to get delivery of trees paid for months before, I got whips when I had bought two-year-olds, and got them into the ground May 13, with five weeks of good time lost. These small stored-over-winter trees looked very slim and cheap beside our 8 and 9 foot ones, but by wetting the roots well and giving them extra care they have lived and started fairly well and are apparently true to name, which is after all the one great point in putting out trees. One can forgive the nurserymen almost anything except substitution or

mistakes in varieties. We will grant that all nurserymen mean to be honest, but still it goes hard to plant a good Baldwin or McIntosh (supposedly) and in four or five years find it bearing a worthless early yellow or greening. It means four years or more to get it back to a worth-while kind by top-working, so it pays to be very careful in buying.

We cut two crops of hay in this one thousand tree orchard this last year. We also cut perhaps a dozen trees among the whips, and mice have accounted for a few more during the summer, so we shall have to replant a score or so. I do not look for damage from mice this winter as I gave them a good dose of lime and sulphur, put on with a brush before snow came; that proves a cheap and effective preventive if applied below the branches perhaps twice a year. These trees are headed about 2 feet from the ground and each has been given two forkfuls of cow manure this winter, which will be dug in when the ground is soft again. They will be pruned back about half their growth and put into shape as they grow.

Now, let me tell you about the seven hundred peaches set for fillers with the idea that they would help pay for growing the apple trees. One year I sold $200 worth from twenty Carmen trees, and that is the only good story I can tell except that there is nothing more beautiful than a peach when it is just ready to drop into your hand. In 1917 and 1918 there were no peaches, just when the trees were full grown and should have done their best. Up to that time I had sold $1,000 worth, and last year they bore so heavily that many were broken down and ruined, with a crop that sold for $1,300, enough to just about pay up for the expense and care they had caused, but little or nothing to help grow the apple trees. This crop was so heavy and the trees so old and high that the expense of picking would have eaten up most of the returns but for the second crop of grass that was so thick under them that I could jar them off as they ripened and pick them up without injury, and they were sold on our lawn by the roadside. Prices were very low because there was not the usual demand for the fruit for canning, owing to the scarcity of sugar.

The pears set for fillers are coming on and have begun to make returns, and, being longer lived than the peaches and

growing more upright and compact, I am hoping that they will be more satisfactory.

The main orchard that was planted in 1910, and later had been severely pruned in the first two or three years to produce strong, sturdy, low-bodied, open-centered trees, has come into bearing as well as I could hope for. The past season I have picked between 400 and 500 barrels, about half Baldwins, of very fine quality and large size, and find that early apples for fillers are more desirable than peaches or pears for quick and good returns. I picked 11 bushels from a McIntosh set in 1912 and 3½ barrels from a Baldwin set in 1910. On the other hand, I had plenty of trees not bearing any.

I have many Baldwin trees that spread 20 feet and Wolf Rivers that are much larger, and I find that the last named are very fine as a baked apple. I tried *one* with my oatmeal for breakfast and it lasted four mornings. Some apple!

Well, I think I have started something in this orchard that will make life easier through my declining years.

As a last word let me say that our Massachusetts Fruit Growers Association is a good thing, and so good that many more should receive the benefit of membership with us. I have obtained sixteen new names so far this year and propose to gain as many more before our next annual meeting, and I believe that many of us can do better than that. At least let each of us bring one new member into our circle.

A Member. At what temperature do you keep your apples in storage?

Mr. Mann. I like to have it about 34. I generally maintain it about there. We have a thermometer at the top of the room. It is the only one there, and I do not care much whether it is there or not. I noticed this morning that it was 38.

A Member. Isn't it all right at 30?

Mr. Mann. Yes, but when you are at 30, you may get to 28 or 26.

A Member. I mean, suppose it stays at 30 all the time?

Mr. Mann. Yes, it is all right if it will stay there.

A Member. What kind of soil did you have?

Mr. Mann. It is a pretty good soil. It is good corn land,

with not much gravel to it. It is a heavy loam, but a good, hardened undersoil and stony ground. In fact, stony ground is pretty good for fruit. Whether it is because there is more potash in it or not, I don't know. On one farm there is quite a little of it cultivated, they raise green crops for their cattle — those apples, as I say, grow larger and bear heavy, but they are not quite the keepers that they are in other parts of that farm or in other places where they are grown in grass. My own orchard is now mostly grass. The first few years I raised strawberries and then tomatoes, and such cultivated crops in it. Some parts have been grass all the time. The parts that have been cultivated the first few years went ahead faster, but I do not look in the end for any better results.

A Member. Do the apples keep better in the upper part of the cellar?

Mr. Mann. The top of the cellar is where you will find the poorest apples. They get a little more heat and a little more light, and they will go a little quicker.

A Member. What do you use for containers to store the apples?

Mr. Mann. As a general thing, good orange boxes, — Florida orange boxes. They are very cheap and very easy to handle. An egg crate is so tenderly made that it won't hold. You might use it once by carrying it a good deal as you would a baby, but they are not safe to use for any length of time.

A Member. Did you take the grass out of your orchard?

Mr. Mann. I have, yes. I have cut two crops out of most of it so far, but I expect as the apple trees grow and the hay grows less, to cut it and leave it on the ground, instead of buying fertilizer. Fertilizer and manure are two things almost out of the question now. The only fault anybody has found with me was from Mr. Bogue. I said to him, "You have said all the nice things, but tell me what is wrong about it." He said, "I can't see anything wrong, unless it is growing a little too fast."

A Member. Did I understand you to say that you had a temperature of 34 when you put the apples in in the fall?

Mr. Mann. No, that won't come until the cold weather.

A Member. About what temperature can you get in the fall?

Mr. Mann. I can't tell you exactly, but we put them in and keep them shut up in the daytime as much as we can, and keep it open at night, to get the benefit of the night air to cool them off. The water is somewhere about 46 degrees, and that helps to keep the temperature down. In fact, I will tell you what is a pretty good thermometer, — a pail of water in the cellar. If it doesn't freeze, it is all right, and if it freezes a little and doesn't thaw, it is all right. You want it just about at that point. I happened to put a board in a week ago, put it on top of a box to step on, and on one end there was a handful of snow. I put it in under another box, set it on it, and I noticed this morning that the bunch of snow was there yet. It has been there a week and hasn't thawed. Still the apples aren't freezing.

A Member. How much growth on the orchard would you call right growth?

Mr. Mann. On the branches a year? I should judge a foot or a foot and a half. A foot is small. Perhaps a foot and a half. I guess they grow 2 feet, sometimes. Of course the small tree will often grow more than that if you let it run up, sometimes 4 or 5 feet.

Chairman Jenks. We have just time for one or two other questions. The question is asked how is the storage ventilated in the winter.

Mr. Mann. Why, I have one window open all the time. I have been kind of scared when this 14 degrees below weather came along, thinking that it might get in there. It is just a window covered with a screen, burlap hung behind it, and that is open on the south side all the winter. That lets some air through. And then I have other places that have been ventilated some. I leave the door open to the south.

Chairman Jenks. One more question.

Mr. Mann. When you take hold of an apple and turn it up that way [indicating] and it comes off fairly easy, that is about the right time to pick it, no matter whether it is going to rain next day or not.

A Member. What kind of apples would you set if you were going to set in your orchard?

Mr. Mann. Set Baldwins for main crop.

The Commonwealth of Massachusetts
DEPARTMENT OF AGRICULTURE
ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 22
March, 1920

MODERN DEVELOPMENTS IN PEACH GROWING

MAURICE A. BLAKE

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

3-'20-2,500

MODERN DEVELOPMENTS IN PEACH GROWING.

MAURICE A. BLAKE, NEW JERSEY EXPERIMENT STATION, NEW BRUNSWICK, NEW JERSEY.

Peach production has occupied an important place in eastern fruit growing since early colonial days. Orchards of hundreds and thousands of seedling trees were common before the Revolutionary War, and peach yellows, the great scourge of the peach industry, had even appeared by that time.

We are, then, discussing an industry as old as colonial America, and you have asked me to address you upon its modern developments. Some one has said, "There is nothing new under the sun," and while I do not subscribe to this, it is often difficult to tell where the old leaves off and the modern begins.

Before we become too deeply concerned with methods and details of practice, it may be well to have a word as to the character of the business, since I infer that it is commercial peach growing that you are principally interested in.

The fruit of the peach, with its attractive colorings, its aroma and luscious flavor, makes a strong appeal to the prospective grower. Its promptness in coming into bearing and the reports of big profits in a single season are the deciding factors that start many a one in the game.

Where the climate and soil are favorable, the peach will give profitable returns earlier than any other deciduous fruit, and may give consistent returns. However, in the east it cannot be depended upon to produce a profitable crop before the fourth season and seldom after the tenth or twelfth season in the orchard. This short life must, therefore, be a merry one if the grower is to be properly compensated, and it becomes doubly so in localities where Jack Frost takes heavy toll.

The peach must remain upon the tree until well matured before high quality is attained, and then it must be soon con-

sumed or preserved. It may be held for ten days in cold storage, but the luscious flavor generally suffers. The period of successful distribution from tree to consumer is commonly a matter of less than a week. A grower, therefore, with several thousand baskets of peaches ripening faster than his available labor force or the railroad will handle them, is certain of plenty of exercise for his mind.

Peach growing is an intensive business which calls for skill, energy and persistence. It is decidedly not a lazy man's game, but played right it is attractive and profitable.

In a discussion of modern developments in peach growing some items of status should perhaps receive first attention.

The severe winter of 1917–18 seriously injured and killed thousands of peach trees in eastern and middle western peach regions, only those in especially favored districts escaping. During the period of the war, labor was difficult and expensive to obtain, and orchards not producing full crops were frequently left uncultivated. These two factors have resulted in a marked reduction of the peach orchards that are now in condition to produce good crops.

The United States census for 1910 was taken when the peach industry was just recovering from the attacks of the San José scale, and that of 1920 will be taken just after heavy reduction due to the effects of war and freezing. The high point reached in 1915 will never be measured in figures.

Together with this reduction in the number of vigorous orchards, there is a marked shortage in the number of nursery trees ready for planting, and a correspondingly increased price upon those that are available, which all points toward good prices for peaches during the next year or two if the crop is properly distributed.

The acreage of bearing peaches can be reduced suddenly, and it can also "come back" quickly, and the present shortage in peach nursery stock will be overcome much more quickly than that of apples. Even now everything resembling a peach pit has been collected and has gone into the ground for the next year. In some districts we may look for a mad rush to get aboard the peach wagon.

When a building burns down and we have the opportunity to erect a new one we should make sure that we have a good foundation on the right site and that all old faults are eliminated in the new structure. The same situation presents itself whenever there is a marked reduction in peach orchards, and during the next few years many will have the opportunity to build wisely and well.

To my mind, peach growers may be classified into two groups, those who have extensive orchards and ship in carload lots to distant markets, and those who have much smaller orchards and supply a more local trade.

The appearance of the roadside market is, in my experience, a modern development that means much both to the large and small peach grower, and especially the latter if he takes advantage of it.

Hundreds of farm fruit and vegetable stands are seen in the summer along prominent auto routes in the east, especially those leading to shore resorts. I have seen automobile parties buying Greensborough peaches from farm stands when they could secure the finest southern Belle and Elberta in Atlantic City, New Jersey, a noted shore resort. I have seen these parties coming out into the country from the resort day after day to purchase such fruit. Why do they do it? Because they think they can get fresher and better fruit. Herein lies the opportunity of the local grower. So long as he offers well-ripened, attractive fruit at a fair price his business will prosper. If he grows and offers especially fine fruit and sells with an effort to please, he will need to hire a traffic "cop" to keep the crowd in line. A successful roadside trade demands especial attention, but it eliminates cartage, freight and commission. Poor quality and indifferent handling of the fruit, or deception and dishonesty in any form, will soon injure the roadside market. One may never expect to see a passing customer again, but people gather together and discuss their bargains and experiences, and automobile parties may be easily discouraged from buying while en route.

I believe there are many favorable sites for small peach orchards in the eastern States where one may develop a profit-

able orchard of a few acres, the fruit from which could largely be sold in a local way. A small orchard isolated several miles back from a main highway might, however, become a liability instead of an asset.

In all of the old peach regions it should not be difficult to obtain information as to what exact sites and areas are especially favorable to peaches. There is no more important point than the right "spot" for the orchard. Once it is planted, you have made a decision as to local climate, exposure and soil which cannot be changed during its lifetime.

Cultivation.

Cultivation is one of the requirements of a successful peach orchard that must not be overlooked. Young peach trees grow rapidly under good cultivation, but stop culture only for one season and they make but little growth and soon appear yellow and weak.

Spraying, cultivation and fertilization are often neglected following a winter when the fruit buds are killed by extreme cold. Then is the time when they need culture as never before in order that they may overcome the effects of the freezing. If, in addition to lack of culture, the injured trees are left exposed to attacks of leaf curl and borers, the end is in sight.

Where temperatures of 10 to 15 degrees or more below zero are likely to prevail in winter, the cultivation should stop early, but it is, nevertheless, essential that cultivation be practiced. In some situations in northern districts only a portion of the land between the trees is cultivated. This may be entirely satisfactory, provided that sufficient growth and vigor result.

Fertilization.

Peach trees that are weak in vigor cannot be depended upon for either good or consistent crops. Cultivation of some soils which have been put in a state of high fertility may promote a sufficient growth of the trees for several years without further stimulation, but under average conditions some fertilization will be required annually.

It has been clearly shown in recent years that nitrogen is more often the limiting factor with peaches than either potash

or phosphoric acid. Nitrogen has a marked effect upon the vegetative growth, which is one of the determining factors in size, color and quality of fruit. We must have a certain amount of growth and vigor to secure crops.

Peach trees can be overfertilized with nitrogen, however, as the summer of 1919 emphatically demonstrated. When it rains frequently during the summer, trees make a much more rapid growth than under normal conditions, even when the fertility of the soil is the same. Fruit upon rapidly growing trees with vigorous foliage is more susceptible to attack from brown rot than fruit upon slow or moderately growing trees. Fruit heavily shaded by foliage does not develop as firm a texture and the skin lacks the protective qualities of that on fruit which develops in sunlight.

By employing a quickly available source of nitrogen, such as nitrate of soda, one may control the growth of his trees somewhat according to the character of the season. A smaller amount than is believed necessary should be applied just as growth begins in early spring to make sure the trees have vigor enough to set the crop. If a wet season follows, no additional nitrogen may be necessary. If, on the other hand, the trees show a need for the nitrogen, an additional application can be made. The effects of an application of nitrate of soda will often be seen within ten days, or, at most, two weeks' time, unless the weather is very dry. I am unable to say just how late it would be safe to make a second application in New England if the trees needed it, but probably June 15 to 20 is within bounds.

Pruning.

Pruning is a topic for discussion in itself and I shall only mention one fact which may be a bit less well known than some others. It is generally understood that dormant pruning invigorates a tree, and this, in general, is true. The character of the pruning, however, largely determines whether any resultant effect will be noted. A light thinning out of the branches, especially near the base of the tree, may result in but little or no increase in annual twig development, while the same amount of wood removed in a cutting back of the tips of branches will do so.

Trees weakened by production or from winter injuries will require cutting back as well as thinning out in order to secure the desired vigor.

Spraying.

The San José scale no longer causes peach growers any worry, which in some instances results in more cases of peach leaf curl because of the failure of the growers to apply a dormant spray. Leaf curl weakens the trees by reducing the foliage in early spring and in severe cases causes the loss of the crop. It is true the trees put out a second crop of leaves, but damage has been done. Thorough spraying with winter strength lime-sulfur in early spring before the buds start into growth will completely control the disease. If applied after the leaf buds show the least bit of green, however, your time and material may be wasted for the year, since the disease will probably have entered the leaves and will develop in spite of any spray.

Dusting peaches for the control of scab, curculio and brown rot in summer is becoming a frequent practice in New Jersey and districts south. A dust comprised of sulfur and arsenate of lead powder without lime was tried out upon peaches as early as 1914 in New Jersey and caused severe defoliation. Experiments the same year in which a mixture of sulfur, arsenate of lead and air-slaked lime were used showed no burning and gave good control of peach scab. A more extensive experiment in 1916 showed that a mixture of 65 pounds sulfur, 25 pounds hydrated lime and 10 pounds dry arsenate of lead was safe to use, and gave good control of peach scab. Since then mixtures of 70–20–10 and 80–10–10 have been used with good results in the control of scab and brown rot. During the past season I have heard of serious injuries to peaches south of New Jersey by applications of dust containing no lime, and of growers who made an application of arsenate of lead without lime with the idea of slightly burning the foliage to gain color. Any one who attempts either of the above is "playing with fire." If you use sulfur and dry arsenate of lead on peaches, do not fail to use at least 10 per cent of lime. It is better to be safe than sorry.

Brown Rot.

A discussion upon spraying of the peach would not be complete without a word as to the serious outbreak of brown rot which occurred in eastern and southern peach regions during the summer of 1919.

An attack upon the blossoms was followed by an extended period of wet weather at ripening time, and some growers suffered heavy losses in decayed fruit, especially of such varieties as Champion. In looking for the cause of the great volume of infection, Dr. M. T. Cook, plant pathologist of New Jersey, found that the disease not only carried over from one season to the next on the dried mummied peaches but also in cankers on the new wood. These cankers continue to develop spores during the early part of the summer, and infect the fruits unless they are protected by spray. Thorough summer spraying therefore protects not only the ripening fruit but keeps down the number of cankers upon the branches.

While brown rot was very severe during 1919, it is doubtful whether weather conditions will prove as favorable for its development in 1920, and a normal, thorough summer spraying should hold it in check. The severe outbreak of brown rot in 1919 served to point out the weakness of some varieties of peaches that are striving for popular favor.

Varieties.

Only a very few varieties of all that are introduced are able to secure a place upon a list of the best five, and still fewer are able to hold such a place for many years. It is of interest to note that Oldmixon Free originated previous to 1800 and held high commercial rank for a hundred years. Heath Cling apparently originated before Oldmixon and is still planted in a very limited way, but has never become as popular.

Elberta, Carman and Greensborough are, therefore, all youngsters who were almost unknown twenty-five years ago. Their introduction was a distinct advance in hardiness, especially the latter two. In the last few years no introduction has been able to win a place from the leading sorts, yet we need better varieties than any we now have that ripen before Elberta.

The New Jersey Experiment Station has more than 2,000 seedlings from known parents that are of fruiting age, several hundred of which fruited in 1919. We hope that at least one of these will be able to advance the standard of present-day varieties.

Although my subject is modern developments in peach growing, I am going to wander a bit in closing in order to bring out some facts which should interest you.

I said earlier that in some sections there was likely to be a mad rush to plant peaches. Some of these will be small farm orchards, some moderate-sized commercial plantings and some of a syndicate nature. History certainly repeats itself in the peach business. Many orchards are never cultivated after they are planted and still others are abandoned after the second or third year. Some plant their whole farm to peaches at the very start and find the burden too heavy for the capital available before a profitable crop is secured and fall by the wayside. I would not advise any one to put all his eggs in one basket, and this is especiallly true of peaches in regions where severe winter temperatures may cause severe damage. It is a good plan to combine peach growing with the culture of other fruits and vegetables or other lines of farming. In fact, this is good advice for any one starting to grow any tree fruit.

Another point worthy of our attention at this time is that there are always seasons when competition is so great that low prices prevail. It is then that the man with favorable location, who can produce peaches at low cost, wins out.

There is a tendency to-day toward the formation of so-called orchard companies or syndicates, who plant out thousands of trees, and they not infrequently limit their efforts to the production of a single tree fruit, so that before the orchard comes into bearing they have a tremendous overhead expense. High salaries to managers and foremen are also common in such enterprises. And while it is true that you can buy tools, spraying materials and fruit packages cheaper in large lots, it becomes increasingly difficult as the size of the orchard is increased to obtain the best results in the form of fine fruit.

To my mind the best results in peach growing are obtained in the long run where one who knows and likes the business

can give it his individual attention, and who stays in the game through the ups and downs that are almost certain to occur. And those who have the welfare of fruit growing at heart like to see a large number of individual owners actually engaged in the growing of fruit.

Mr. Blake. Perhaps I could interest you more if we could have a discussion of any of the questions which may come to your mind. The peach-growing industry in New Jersey is one in which all phases bring questions forward, and the modern developments at the present time seem to me largely those of the question of getting started right and the details of carrying on the work. Sometimes I think a certain fact or a certain principle is new, comparatively new. Then I will run across some old report of a State horticultural society or an old garden magazine and find that some man fifty or sixty or one hundred years ago said the same thing, so it is hard to tell where the old leaves off and the new begins.

Mr. Parsons. On the foliage spray, does it pay to put it on in the years when the buds are frozen?

Mr. Blake. Why, if you have an orchard in good condition, I think it would certainly pay to protect that against leaf curl, if you are likely to have leaf curl.

Mr. Parsons. That would be the dormant spray?

Mr. Blake. That would be the dormant spray. In the summer time, if there was no crop, I do not think that would be necessary ordinarily. You could save that. But some culture and fertilization to keep up the vigor would be desirable.

A Member. The brown rot is apt to affect the foliage, I understand; and what spray would you spray for that? We find the small twigs dead, caused by brown rot.

Mr. Blake. Yes. I think if your orchard is without a crop, I do not think it would be necessary to go through a thorough system of summer spraying. Now, I suppose that some of the plant pathologists and others would disagree with me there, — the idea is to spray and keep spraying, but we carried on an orchard in a commercial way in connection with our work, and I also looked at it from the economical and money side; and if I had an orchard, even in New Jersey, where the rot is un-

doubtedly more severe than here, — it is more severe as you go south, — I would spray it for curl and cultivate it so as to keep it in good vigor. But I would not do very much summer spraying. That is my personal opinion. I think I could save money there. I do not fear the brown rot so very much. I think with thorough spraying in the season in which the crop is produced you can hold it down, unless you have some variety like our old friend Triumph, when it is almost a race to see whether you can get to the station with it before it rots, but I think with ordinary varieties it would not be necessary to summer spray very much in the season when there was no crop.

A Member. The dormant spray which controls the leaf curl, I presume that is also good to control brown rot on those cankers. Would it hold that in check, to some extent?

Mr. Blake. Well, not very much, in our experience. It was found this past summer that those cankers putting up growths kept producing spores, and the winter spraying will not prevent that. But without a crop in the trees, and in this section, I do not think it would be serious.

Mr. Parsons. Does brown rot ever kill the Champion trees?

Mr. Blake. I do not think so. Champion is going out with us very fast, and we won't have any for it to kill there in a few years. It is so uncertain as a shipper, it rots so easily; and I will always remember the season of 1915, when I went into New York one morning with the market already heavily supplied with yellow peaches and saw 16 carloads from West Virginia, where they had cold weather, and they were all clingstone. That 16 carloads of Champion broke the camel's back. That is, it was a lot of clingstones in there that were rotting, and it hurt the market.

Mr. Parsons. Have you found anything to take the place of the Elberta peach?

Mr. Blake. No, and I do not think we will for a few years. I think very few of the fruit growers realize that in the Elberta peach you have a commercial variety that has a record that no other commercial variety tree fruit can match. It is either the first or second variety of importance from Connecticut to

Georgia, and east and west to California. It has a great range of adaptability, and the ability to come across better than any other commercial variety we have. Now, we are using Elberta in our crossing in New Jersey, to obtain new varieties, but I think it will be some time before we get varieties that will exceed that one in all its qualities. We have some of our most interesting seedlings that are crosses between either the Belle and Elberta and some other variety.

Dr. Fowler. What is the best spray for brown rot, and how often do you use it? I have a small orchard, and it was nearly killed by brown rot last year.

Mr. Blake. In my experience, thorough spraying with any of the good summer sprays is the best recommendation to make. We find self-boiled lime-sulfur a little bit the most effective spray; but last summer our growers who dusted several times late in the season after that wet period got very good results; and some of our growers used the commercial mixture known as "atomic sulfur." I believe either of those materials applied thoroughly and at frequent intervals will hold it in check. Of course, this thing was true: some growers two years ago did not pick their orchards clean at ripening time, and they left some peaches on to get very ripe for the local trade, and those orchards gave the most trouble from brown rot last year. The orchards that were picked promptly and clean did not suffer as severely as the others, but I think it is in the thoroughness of the spray and increasing the number of sprays in a bad season that are the most important points in controlling the rot.

Dr. Fowler. What is the name of the last spray?

Mr. Blake. Atomic sulfur is a commercial material that many of our growers use.

Mr. Parsons. How many sprays would you recommend?

Mr. Blake. Well, with us we would use three or four summer sprays in a wet season like the last one, and I think some of the men put on more, but we have a fairly long season, and we have peach scab to contend with in southern New Jersey every year. That is a disease that causes little black spots to come on the fruit. We have that every year, and what our growers did last season was to apply an extra spray. We had that rainy weather after a period when we would ordinarily

stop. They dusted and sprayed again. The men that did that saved the crop. The ones that did not suffered severely from rot. We did the same thing with apples. The growers who put on a late spray on the apples in August, which they ordinarily do not apply, had fruit free from the sooty blotch and fungus. In other words, the spray schedule that any section might have should be a basis for guidance. That is all. You have to vary that somewhat according to the season, and our growers put on an extra spray.

Mr. Donald MacRae. Have you seen any orchards that have entirely controlled the different fungi and insects by the dusting method? In Massachusetts this last year, — what I mean to say, been controlled entirely without any wet spray? What has been the result?

Mr. Blake. The question is, whether dusting will control all of the insects and diseases? No, I do not think so. I think we have to depend upon our wet spray in the winter leaf curl. Personally, where the rot is serious and where we have peach scab as serious as we had in southern New Jersey and south, I think a wet spray, just as the fruit sets, before the shooks are off, is a good thing too. Then, I think you can dust with good results. Most of our growers thus far have put on one or two winter sprays and have then dusted, but I do not believe that you can depend upon dusting to control leaf curl.

Mr. Van Meter. What are your best controllers for curculio?

Mr. Blake. What are our best measures for control of curculio? First, a little as to our experience with curculio. We find that orchards that are surrounded by grass lands give us more trouble for curculio than where they are surrounded by cultivated area.

It is a common statement that curculio is more prevalent where orchards adjoin woodlands, and that is true to some extent, but they seem to be able to harbor very well in grass land.

In the second place, we believe that thorough summer spraying just at the time the fruit is setting and about ten days to two weeks after is the most effective means to control curculio with us.

Now, some of your station publications and schedules are a little weak on one point. They say, "Spray when the shooks are slipping, or when the shooks are well off," and until about two or three years ago our growers were about two or three days late on that spray.

With us, the curculio begins to attack the fruit just as soon as the calyx has slipped away from the stem. If it is only one-eighth of an inch, then the curculio starts in, and if you examine those peaches carefully, you can find the punctures and the egg laid, so we believe you must start just as soon as the calyx commences to slip. If you wait until half of them are off, a lot of curculio damage will have been done.

In our experience, the curculio question is not serious when you have a very heavy set of fruit. They take off 20 per cent. There is plenty left. It is serious when you have just enough to make a crop. Then you can't afford to give any away. Then it is important to put on that spray early enough.

The curculio last year got fooled somehow with the weather. It did not show up with us until the peaches were three-quarters of an inch in diameter, so we had very little dropping of the fruit as the result. But that is an exception to the rule.

Mr. Roach. What winters, in your experience, would you say would be the most detrimental or the most favorable to the perpetuation of brown rot?

Mr. Blake. What kind of winter? The question is, what kind of winter would be the most favorable or detrimental to brown rot? I do not believe the winter would make very much difference. I believe the disease is able to stand cold as well as heat, but I doubt whether the winter would have very much effect. These cankers will produce spores the next spring if the weather is favorable. They will continue to produce them during the spring and summer, so it is summer spraying you must depend upon to hold it in check.

Mr. Chessman. After a good winter freeze, I would like to ask a question as to whether you would advise light or moderate or severe pruning.

Mr. Blake. In my experience, that would depend on the age and condition of the tree. If the injury were slight and I

had two and three year old trees in good form, I would prune them about the same as I always would. If they were older, I would cut them back fairly well. If they were very much weakened in vigor and nearing the end of their bearing age, I would cut them back severely.

Mr. Mayo. I would like to ask what your idea is in putting in a new orchard where you have an old one.

Mr. Blake. Would you plant a new orchard on the site of an old one?

Mr. Mayo. Yes.

Mr. Blake. I would rather not do it for one or two years. I think it would pay to put that land to some other crop for a year or two and get it back into uniform shape. After the trees are planted, it is not as easy to improve the soil. However, it might be possible, if the land was in a high state of cultivation, to grow an orchard there immediately after one has been taken out, but I think it would be best to rotate it for a year or two.

Mr. Knowles. You spoke of dormant pruning giving vigor to the tree. Now, up in New England here so much of a peach tree will winterkill that we do not know which is going to live and which is going to die. We hardly know which branch is going to bear and which branch isn't going to bear until towards spring, and sometimes we are compelled to wait to ascertain those facts before we can do any pruning at all, or we may simply cut off the branches that are going to live and leave those that are going to die, or cut off the branches that are going to bear and leave those that are not going to bear, in dormant pruning.

Mr. Blake. Well, when you have winter injuries late in the season, it does disarrange your program some. You do not know in November or December what you are going to have left in March or April, and sometimes it is necessary to prune rather late in the spring. But by late winter and early spring, you should know something about what your trees are likely to do.

Mr. Campbell. If a person has a roadside stand, what would you recommend planting to come in between main varieties of the Greensborough, Carman, Belle and Elberta?

Mr. Blake. Varieties coming in between Greensborough and Belle?

Mr. Campbell. Between Greensborough, Carman and Elberta and Belle in the time those peaches are not in the market and you have a roadside market and want to continue.

Mr. Blake. The question is, a man has a roadside stand, what varieties should he grow to fill in between Greensborough, Carman, Belle and Elberta?

Now, I haven't studied the roadside situation in New England. I do not pretend to know it as intimately as I do in New Jersey; for roadside stands our people start with Greensborough. Usually the next variety is Carman. Some follow that with Lola, which is practically a freestone Carman, ripening about a week later. Then the next most common variety is the Hiley. We find that variety has to receive special attention in pruning, after the first three or four years, if we want good size. It needs to be pruned back harder than some of the others; otherwise, the fruit runs a little small.

Then our people still have the Champion, but it is growing less popular every day because of its susceptibility to rot, and more of them are growing Belle and Elberta. With us, the Arp and Rochester have not been satisfactory. So that we still stand upon those older varieties.

Of course, you can vary the ripening of any variety a week by your method of culture. For example, Elberta upon light, sandy soil, not heavily fertilized, will ripen a week earlier than Elberta that is well fertilized, so that you can extend the ripening of a variety a little by the way you handle it, and the few varieties mentioned would practically cover the season as we have it now.

Mr. Packard. I would like to ask in regard to spraying at the time of blossoming. I ask this question because in our section in Plymouth County they are now considering the killing of the bees, — as the bees are looking after their honey at that time, — as the spraying, the poisonous substance used, is killing off the bees.

Mr. Blake. The question is as to my opinion of spraying the peach while in full bloom. I do not think it is desirable, and I do not think it is of any use. I heard it suggested at a

meeting two weeks ago that it would help to control blossom blight caused by the brown rot in early spring, but I do not believe it would help at all. It won't help in the control of curculio, and if it doesn't help in the case of brown rot, why do it? No, I can't see any advantage in spraying at full bloom, and I wouldn't advise it.

Chairman Munson. We generally go to New York State to get an authority on apple-grading laws. We have done it in this case, and the subject is a very important one to Massachusetts growers, and I thought we ought to have some one here who had had a little experience in demonstrating apple-grading laws, so we have Mr. B. D. Van Buren, assistant director, Bureau of Plant Industry, Department of Agriculture of New York, to discuss this important subject with us.

Mr. Van Buren. Just before I start my paper, I would like to say a word in regard to the question of pruning, which was raised in Mr. Blake's talk. I think that where you have peach trees eight to twelve years old, which have been very badly injured by the winters, — I believe that severe pruning would seriously injure the tree and might kill it, and that really moderately heavy pruning would give better results than the severe pruning along dehorning lines.

Mr. Blake. I tried to make it clear that we did not believe in dehorning trees in good bearing condition, and that we did not alter our pruning very much on young trees, but when an orchard gets to the point that it is very, very weak, and is about ready to go out, our idea is if it isn't pruned back, you might as well pull it out, whether it is winter injured or not, but that would mean orchards that are about ten years old. On those orchards you would either try to renew them or take them out if they were severely injured.

Mr. Van Buren. If they were severely winter injured, and I calculated to pull through, instead of giving severe pruning, give them a moderately heavy pruning and give moderate thinning out.

Mr. Blake. It is one of the points that might interest you. We believe it is a mistake to let an orchard go in pruning until about the tenth, or any renewal pruning until about the tenth year, so that if you want to renew it you have to dehorn it.

The suggestion is that the part be pruned out in the center, so that the year before you would cut back severely, you would get a lot of new suckers and new growth inside, and then by cutting back you have a new top without heavy pruning. I did not intend to convey the idea that we would approve of heavy dehorning of orchards of trees that were in good condition, — six or seven years of age, — but only after they were very, very weak and ready to go out.

The Commonwealth of Massachusetts
DEPARTMENT OF AGRICULTURE
ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 23
March, 1920

APPLE GRADING LAWS

B. D. VAN BUREN

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

3-'20-2,500

APPLE GRADING LAWS.

B. D. VAN BUREN, ASSISTANT DIRECTOR, BUREAU OF PLANT INDUSTRY, DEPARTMENT OF AGRICULTURE, ALBANY, NEW YORK.

Why an Apple Grading Law?

Because all commodities that are in general trade are handled to a much better advantage in a large way if standardized, and such standardization cannot be generally obtained in food products except by some compulsory standard defined by law and some body with authorized power to enforce such standardization.

The apple trade of many of the States is now one of the large items of their agricultural income.

The United States total apple production in 1918–19 was as follows: in 1919, 49,152,000 barrels valued at $275,463,000; in 1918, 56,697,000 barrels valued at $225,562,000; approximately 7,535,000 barrels less in 1919, valued at $25,000,000 more.

The commercial crop was estimated as follows: in 1919, 26,174,000 barrels valued at $154,950,000; in 1918, 24,743,000 barrels valued at $126,684,000.

The difference between the commercial and total crop as given by government statistics would indicate that 23,000,000 barrels of apples in the United States have been used for home consumption or sold locally or used in by-products. It is estimated that 9,830,000 barrels have gone into by-products, principally cider, vinegar and dried apples.

We, apple growers of the barreled apple States, are face to face with a keen competition, which is cutting into *our* markets for our best grades of apples to such an extent that we must wake up and that quickly.

I refer to the western box apple trade, — one of the great reasons why we should have an apple grading law. Western

box apples are standardized to such a degree that, opened top, side or bottom, what you see represents the entire contents of the package. How about the barrel that was packed before any apple grading law was enacted? Could you tell from looking at the top or bottom what was contained therein except apples? How about the barrel that is now packed under the present apple grading laws of the various States? Better? Yes. Possibly you do not all agree with me, but handlers, commission merchants, retailers and all that I have talked with agree that it is much better than a few years ago. But all agree that there is yet room for much improvement, and if you growers will go down with me to the wholesale markets and compare the average box with the average barrel of apples found there and being offered for sale, you could not help coming away with a feeling of discouragement and even disgust with the poor showing that many of our eastern barreled apples are making compared to the western box apple.

Relative to western box apple competition I would like to submit the following data relative to New York City markets, and I believe that to some extent at least the same general condition exists here in Boston: —

From August 1 to December 31, 1919, there were received in New York City 5,578 cars of apples of which 2,973 carloads were barreled apples, 1,791 of which originated in New York State, and 2,605 cars were box apples from the western box States.

During the same time, in 1918, there were received in New York City a total of 6,056 cars of apples of which 4,701 carloads were barreled apples, 2,788 of which originated in New York State, and 1,355 cars were box apples.

During the whole season of 1918–19 there were received in New York City a total of 10,627 cars of apples of which 7,772 cars were barreled apples, of which 5,201 came from New York State, that is two-thirds of the barreled apples sold in New York City, season of 1918–19, came from New York State, and during the same season there were received 2,855 cars of box apples.

The car lots of barreled apples received in New York City, season of 1919–20, up to December 31, 1919, originated as follows: —

West Virginia,	131	New Hampshire,	8
Delaware,	37	Connecticut,	12
Nebraska,	1	New York,	1,783
Massachusetts,	180	Pennsylvania,	27
Arkansas,	5	Maryland,	46
Nova Scotia,	9	New Jersey,	232
Missouri,	3	Wisconsin,	2
Unknown,	2	Indiana,	1
Virginia,	263	Vermont,	95
Rhode Island,	3	Illinois,	1
Maine,	121		
Long Island,	8	Total,	2,973
Michigan,	3		

Many of our apple grading laws are not drastic enough. They go only part way, and the reason why they have gone only part way is largely because of the opposition of growers who yet believe that they have the right to put over a raw deal upon the consumer.

I can talk a little stronger here, possibly, than I would dare to do in New York State. You have a better law here than we have, and I might say that in New York City it has been recognized, during the past few months, that Massachusetts A grade usually stands for good packs and some of the best Baldwins on the New York City market have been Massachusetts Baldwins. But some growers want to put in as many poor apples as possible. Then the person who buys the barrel, which opens up beautifully at the face end, and maybe is good to look upon at the press end, while two-thirds of the apples in the barrel are so much poorer than the face end, feels sore. Even if he bought them at cider apple prices, he, at heart, feels he has been stung.

Trade in a commodity is bound to lag if there is no standardized grade and one does not know what he is buying until he sees the pack.

A State or National Apple Grading Law?

I believe, and many growers and dealers in New York are of similar belief, that we should have a national apple grading law, supplemented by State laws similar in nature, and eventually we will all have to come to this view. Some, at least,

of the best authorities on agricultural law and interstate trade feel that we, in New York, are treading on dangerous ground when we insist that apples grown and packed in New York State, or any State, must be branded and packed in accordance with the State apple grading law, when, as a matter of fact, the goods are for export to other States or foreign countries. Good lawyers doubt if the law will hold water when the apples are going outside the State in so-called interstate trade. A Federal law would obviate all doubt upon the subject, and we would be able to catch easily the fellow who now ships out "unclassified" and after getting them outside the State shaves off the "unclassified" and labels them "A Grade," or else ships out carlots unmarked as to grade and so poor as to be unclassified and marks them a standard grade after getting them outside of the State. I think you, in Massachusetts, have the same difficulty but to a smaller degree than we in New York. We feel the need of such a Federal law and will give such a law our hearty support. About the only opposition will be from those that want no apple grading law of any kind. Optional laws have been tried out, both Federal and State, and from their influence upon the trade are not worth the time it takes to pass them or the paper they are printed upon.

Some Essentials of Any Good Apple Grading Law.

The face must be a true representation of the contents of the package. We have got to come to it in New York State. All of the barreled apple States have got to come to it. Uniformity of grade — you see top, you see all — sells western box apples, sold Hales' Georgia peaches, and will sell barreled apples from barreled apple States. Buyers have reached the point of no patience with the snide pack, package or packer.

Canada had to require that the face should truly represent the pack.

The West Virginia law states, "the facing shall fairly represent the contents as to size, color and quality."

Delaware has gone further and requires that the face "shall be truly representative of the size, color and quality of the apples in the package."

Pennsylvania requires that "face or exposed surface shall

fairly represent the average of the apples in the package," and goes on to state that "it shall be considered a fair representation if the face does not excel the average of the apples in the package by more than 15 per centum in the matter of size and freedom from defects." But the Pennsylvania law establishes no grades.

Maine states, "the pack should be uniform throughout except in barrels, the facing should be made of apples of uniform size, color and shape. The apples used in facing should be a part of the grade in the package; they should not be taken from a higher grade." "Should be" is not a term positive enough to put in any apple grading law.

The Vermont law not being compulsory, it is probable that most of the apples packed in Vermont which have complied with the law as to packing and branding, have been so packed because these grades were generally recognized in the markets of the east where their fruit is marketed.

Massachusetts requires that the packages shall not be overfaced.

The tolerance allowance for standard grades should be small, and the poor, indefinable term, now used in many of the laws "practically free," should be defined in the laws to read: "Practically free means free from all defects except for tolerance allowance." Such terms as "should be," "fairly represent," "materially deform or discolor," etc., are too indefinite and make the prosecution of violations difficult.

The following barreled apple States have apple grading laws: Maine, New Hampshire, Connecticut, Massachusetts, Vermont, Delaware, New York, West Virginia, Michigan, Pennsylvania, and possibly one or two other States.

Provisions for Educational Work among Growers and Packers. — Certainly an attempt should be made through Farm Bureau organizations and local fruit growers' associations to fully inform growers and dealers as to the requirements of the law and how they can best obey its mandates. The requirements must not be so high that it is impossible to obey them if reasonable care is taken, and should not greatly hinder the speed of packing operations.

How enforced.

And, lastly, it must have teeth. A compulsory law will soon fall into disuse and disfavor if adequate penalties are not provided and action is not brought against violators promptly and carried through to completion.

Under our New York law it seems almost impossible for us to get prompt action. By that I mean it is impossible to get the defendant into court before several months or a year after the violation. I know that the effect would be much better if we could reduce the time to ten days or two weeks. However, even with this delay and a comparatively few men inspecting for the enforcement of the law, a great change has been made.

In looking over the New York markets to-day we find but few shipments in which the packer has not tried to obey the law. This is also true in shipments from those other States that have compulsory grading laws.

In New York we employ from four to twelve men from September to May on this work, largely making the inspections at shipping points, storage houses and the large city markets. From two to four men are kept busy in New York City, and the fruit is largely inspected there when unloaded from car to boat. This is comparatively easy as 95 per cent or more of the New York apples going to New York City arrive there at two railroad stations and three Hudson River steamboat docks; probably two-thirds of the New York apples that go to New York City are unloaded at Pier 17, North River.

This year up to January 15, 2,300 inspections have been made, 40 cases have been referred as violations, and 213 people have violated the law in some minor manner, which has been taken up with the violator by correspondence.

I have spoken of western box apple competition, and you should realize that this year in particular it has made great inroads upon the barreled apple trade. As seen on our markets, they excel our apples in color, finish and uniformity of both size and grade in the package. Those are their selling points.

Eastern barreled apples have a reputation for better flavor, texture and keeping quality than the western boxed fruit. Is there any reason why we cannot equal the West on uniformity

of size and grade, and then put our flavor, texture and keeping quality against their color and finish? And with our best colored varieties we can come pretty close on the color and finish proposition. So close, indeed, that if we, in other respects, equal them, we shall find our apples retaining their part of the best dessert trade, which, as a matter of fact, is to-day drifting rapidly to the box. It costs now $2.30 in freight and tax to bring a barrel of box apples to our eastern markets. This will certainly be a great handicap in years of plenty and low prices.

When we have packed and have on sale apples described above, we can go into the advertising game in a State-wide way and not before.

Mr. Houston. I live in New York. I would like to know what becomes of the good apples in New York State or anywhere else. I belong to eight or ten horticultural societies, and I have been chasing good local-grown apples all the way from Kansas and Minnesota down to here for the last sixteen years, and I have attended most of the horticultural meetings in the Central West and the Eastern States, and I have always made it a practice to go around town and see if I could find a respectable apple, a sound, local-grown apple in the town, and the only town east of the Rocky Mountains in which I have ever found a local-grown, — by that I mean grown in the same State where the town is, — the only town I ever found a respectable local-grown apple in is the little village of Dover in Delaware. There they were just the Delaware apples, good, nice and sound apples grown in Delaware, at retail; and I have been over to Rochester a good deal. I have never been able to find a good local-grown apple in Rochester. They are always hollering there about the apple market being good. It is the same way in Maine when I go there. I can't find anything but culls; I never saw anything but culls around this town of local-grown apples. There may be some. I wish, Mr. Van Buren, some time you would come to Washington Heights and see if you cannot find a respectable New York apple in the four or five miles of local markets that are run by the Italians and the Greeks up there. I fail to find it.

You see barreled apples sometimes, but you dig into those

apples and there isn't a sound apple in the whole barrel. I don't know whether they sell the face of the apples separately or not, but what is the result on the retail trade? Why, they don't buy any apples. That is all there is to it. I was raised on a New England farm where we had apples fit to eat. What is the final result of the operation? We all buy citrous fruit. Simply got to buy it. Simply got to buy it in New York City to get any fruit fit to eat, unless you buy western boxed apples, and you may consider western boxed apples cost you 10 cents apiece. I can get three very good grape fruit for a quarter. What do I buy? I buy the grape fruit, of course, as everybody else has to do. It seems to me the apple grading law is good, and it rather arouses interest in seeing if anything can be done to get into the market a respectable local apple where the people that live in the State can get some of the apples that grow in that State and get them in good condition. I wish somebody would get busy about it.

Mr. Van Buren. Well, the gentleman certainly brings a point out about the city of Rochester. I am quite well acquainted with it. The good apples they ship away, and they sell the culls there. That is just about the size of it. You can't find in a fruit store good local-grown apples. Rochester has got one large grower. Syracuse has got one large grower.

There are several stores there that handle Hitchings apples, which are brought in there by crates and in crates and sold there, local-grown apples, but a lot of us really get away from that local market, particularly here in New England. Isn't it so? And in, possibly, your State they get away from that good local market that we have right at our doors, — people that would like to buy good apples and pay good prices for them.

Now, there are a lot of good barreled apples grown in about New York City. I do not know who buys them. I do not know to whom they go. It is a mighty big place. At the same time, the proportion of good apples may be very small to the total proportion of poor ones, but this buyer for Butler's stores,, — of course, they are grocery stores and supply the general housewife, — he said, "why, we buy Baldwins and Greenings, almost exclusively." By the way, if you here in New England are going to grow apples for the New York

market, I would ask you to keep an eye on Rhode Island Greenings. There isn't an apple selling better in New York City than Rhode Island Greenings. It pretty nearly tops the market.

One thing you can get good money for is good Northern Spy and McIntosh. They wanted good apples. He said they very rarely bought anything below A grade. He said, "We have bought some marks of B grade, when the mark was exceptionally good and was a good pack." But who handles those good barreled apples, I don't know. I do not know where they go to. If we are going to get that trade, we have got to put our apples up better. There is no question about it, or else a large part of our eastern barreled trade goes for pies and bakers' stuff and for household use.

And certainly they can't grow anything in the West which can exceed, and I think will hardly equal, our best Spies or McIntosh, or some of our better varieties.

In fact, I do not know anything they can grow in the West which is any better than a well-grown, well-colored Baldwin, which isn't too ripe, from Hudson valley or East. I tell you, the Baldwin is pretty good dessert fruit if it is properly grown, and it is a good cooking apple, besides.

Dr. Twitchell. Recognizing, as we all do with our interest in growing apples, the need of stringent legislation, it seems to me that we never will get results satisfactorily until we get back to some of the underlying facts or principles.

Enforcement of any law is always dominated by public opinion, and public opinion is simply the opinion of the individual in the aggregate. Therefore, we must deal with individuals if we are going to secure the public opinion neeessary to insure the enforcement of any law which has teeth in it. The need of law is necessary. It seems to me that there was necessary more thorough work by the inspectors, more general work along educative lines.

I know that our Commissioner has recognized that fact, but hasn't had the appropriation necessary to do the work which he wanted to do. That is, we must secure, if possible, funds by which and through which men may train men, and they may be sent into all the sections during the apple packing

time, there to work with the packers. There, I believe, is where we must do more missionary work than we have done in the past, and that it may lead up to more uniform packing.

I have in mind one buyer who has had twenty-six to thirty men in my State during the past season, the past year, and he sent out good men, faithful men, to pack, but there must have been an inevitable variation in the standards of packing by the different men in charge of the group; and I think our inspectors at the cars should be more careful, because the cars are loaded from half a dozen or more orchards, and only one or two barrels opened for inspection, and no idea of the actual condition of the car.

It seems to me we ought to get back to the primitive work, if you may call it so, educative work in packing sheds at the time of packing the apples that the owners and growers may receive the benefit of training as well as the packer and avoid the friction which grows out of any drastic enforcement of stringent legislation.

The Commonwealth of Massachusetts

DEPARTMENT OF AGRICULTURE

ARTHUR W. GILBERT, Commissioner

DEPARTMENT CIRCULAR No. 24

March, 1920

WINTER INJURY TO FRUIT TREES

W. H. CHANDLER

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

WINTER INJURY TO FRUIT TREES.

PROFESSOR W. H. CHANDLER, POMOLOGIST, NEW YORK STATE COLLEGE OF AGRICULTURE, ITHACA, NEW YORK.

In preparing this paper I am assuming that the growers are interested primarily in the losses due to the killing of the wood of the trees during such winters as that of 1917–18. So while the killing of buds or blossoms is more common, particularly in case of peaches, cherries, some of the plums and apricots, I shall confine myself largely to killing of the wood.

Before describing the injuries that were to be observed following the winter of 1917–18, it seems well to review briefly the knowledge gained before that time through experimental studies as to how plant tissues are killed by low temperature. Some of the things that we knew were, first, that, unlike animals, plants possess no ability to maintain a temperature above that of the air, that is, the temperature of the wood or buds of the tree follows very closely that of the air temperature. There are a few exceptions to this rule. Thus, in the case of the trunks of very large trees, on account of the slowness with which the heat is conducted through the tissues, the temperature may remain several degrees above the air temperature. This may be of considerable importance; thus it is well known that the lowest temperature is likely to be just before sunrise. The temperatures then begin to rise somewhat rapidly. If at that time the temperature of the tree trunk should be several degrees above the air temperature, it may thus be saved from reaching a killing temperature. Small tree trunks on this account may sometimes reach temperatures lower than the large ones and may therefore be killed when the larger trunk, whose tissues are no more resistant, may survive.

The plant tissue may have a temperature different from the air temperature when the sun is shining brightly because the dark color of the tissue absorbs the sunlight. We have thus known the trunk of a tree on the side next to the sun to show a temperature of more than 20 degrees above that of the other side, and the dark twigs may on this account show a temperature of 15 or 20 degrees above the air temperature. When the sun is not shining, however, we are generally safe in assuming that the tree tissue, except in case of very large trunks, is at a temperature very near to that of the air. At a few degrees below the freezing point, therefore, we will generally find ice throughout the tissue.

We also knew that in some way this ice formation is associated with the killing of the tissue; at least, tissues that kill at rather high temperature will not be killed unless ice is formed. Thus it is known that water may reach a temperature several degrees below freezing without ice formation. The juices in the plant may sometimes do the same thing. If, when the plant tissue is thus supercooled, it can be warmed back up to above the freezing point without ice formation, no injury results, even when the temperature to which it had fallen was low enough to kill it if ice had formed. This, of course, does not mean that ice formation always kills. More of the water must be in the form of ice to kill some plants than others. In case of the wood of our trees, nearly all the water is frozen out before killing takes place. We, of course, do not know whether the killing results from the taking of the water away from the protoplasm in ice formation or whether it is the extent of the ice mass crushing or otherwise injuring the protoplasm.

It has often been said that if the tissue thaws slowly it may be uninjured, when it might be killed by rapid thawing. This is true in the case of ripe apples and pears, provided the temperature has not been too low. With these fruits in storage, if it becomes cold enough to kill them partially, the injury may sometimes be avoided by keeping them where they will thaw very slowly. This does not seem to be true of any other tissues; thus, in case of the wood of our trees and certainly in

the buds of our peaches, if they reach a given temperature, they kill regardless of how they thaw.

The rate at which the temperature falls, however, has much to do with the amount of killing; thus I have been able to kill peach buds at a temperature above zero F. by freezing them very rapidly, and I have been able to kill the tissues of fruit trees in winter at a temperature but 7 degrees below freezing, when with slow freezing they would have stood very much lower temperature. This is of practical importance in several ways. Thus, generally, peach buds will be killed at a temperature of 12 to 15 degrees below zero, if the temperature fall is rather rapid, let us say if the buds have been thawed within twenty-four to forty-eight hours of the time they reach this temperature. A few winters I have had occasion to observe the killing of peach buds when the killing temperature came at the end of a long, cold period. While there had been fluctuations in the temperature, the fall had in reality been rather gradual. On such occasions I have known a considerable crop of peaches to be borne on a summer following a temperature of —24 degrees F. The greater injury following rapid temperature fall is also to be observed in case of sun scald. It is not uncommon to see the southwest side of the tree killed. From our studies the explanation of this killing seems to be that on a clear day in winter the temperature on the southwest side may be high enough to thaw the tissue even when the air temperature is nearly zero. As soon as the direct sunlight goes off of that tissue it drops almost instantly to that of the other side of the tree. Then, if the night following is very cold, it is more liable to be killed than if the temperature fall had been more gradual.

The killing seems to occur on a single cold night rather than as the result of long-continued freezing. This is known to be true in case of buds, for we can thaw them and examine them the next day and find them dead. In case of the wood, if we freeze it artificially, we find that it is killed by temperatures about the same as those reached on the extremely cold nights. This may explain why trees are often killed worse in one little section than in another that seems to have about the

same temperature. Thus, during the winter of 1917–18, there was much less injury toward the western end of Lake Ontario than in the counties farther east, but still on the lake that should have the same lake protection. Probably, except for the cold night of December 30, the temperatures ran about the same, but on that night there was a cloud hanging over the western end of the lake and the temperature did not go nearly so low. It seems probable, then, that it was on that night that the killing was done farther east.

Of course, in case of wood, the amount of injury suffered at any temperature is influenced much more largely by the ripeness of the wood than by anything else. This does not mean that the weakest trees that cease growing earlier are necessarily the ones that suffer the least injury. We shall see from experience in 1917–18 that proper maturity depends upon the presence of a large healthy leaf surface. Then, too, the recovery of the tree does not depend entirely upon the amount of tissue killed. Thus, if two trees of unequal vigor have an equal proportion of their wood killed, the more vigorous tree will generally make the better recovery.

During the summer of 1918 I had an opportunity to study the effects of the preceding severe winter in nearly all sections of New York and in some sections of Canada, Vermont, Massachusetts and Indiana. There were many different kinds of injury to be observed, and it seems wise to describe some of the more general ones.

If a bearing tree were injured but little, what injury there was would generally show by the browning in the sapwood of the spurs. If the injury were greater, this browning was likely to be found in the sapwood in any portion of the tree above the snow line. In the case of Baldwin and Greening, there was often browning in the twigs when the amount of injury back in the branches was not great enough to cause serious harm. On the other hand, with Ben Davis there was often very little browning in the twigs and very much near the base of the branches. When the browning was in the twigs and smaller portion of the branches, the growth in the following spring was very weak, the leaves being much smaller than normal. On the other hand, when the twigs were but slightly injured and the

browning was severe toward the base of the branches, as in the case of Ben Davis, the early summer growth would often be nearly normal, but as hotter weather approached the leaves would suddenly wilt. Of course it is well known that the water moves up to the leaves through the sapwood. Naturally, if the sapwood were largely killed, the movement of water would be interfered with. In the case of Ben Davis, it seems that in early spring, before the weather was hot enough to cause great loss of water from the leaves, they could secure a sufficient amount through the injured sapwood, but, when the evaporation became greater, they naturally wilted. In the case of Baldwin and Greening and some other varieties, where conditions were favorable there was marked improvement during the summer and particularly during the summer of 1919. This was to be expected, since the cambium was not killed and a new layer of sapwood was soon formed. Where the soil has been kept in good condition, the tendency has been for the recovery to be more rapid toward the base of the branches, so there are very many water sprouts formed. The recovery from this sapwood injury has been much better where the nitrogen supply was abundant; thus, in case of some peach trees in our own orchard, trees fertilized in the spring of 1918 with about 3 pounds of nitrate of soda to a mature peach tree recovered very much better than alternate trees not so fertilized. It is now known that when plowing is delayed until late in the season the nitrogen supply in the soil is very much reduced. Our apple orchard at Ithaca was plowed in the fall of 1917 and again in the fall of 1918, so there should have been a maximum of nitrates in the soil during early summer when growth is most rapid in case of both seasons. In addition to this, we applied 3 pounds of nitrate of soda to the tree early in the spring of 1918 and 4 pounds early in the spring of 1919. We had careful records as to the amount of winter injury suffered by each tree as indicated by the growth at the beginning of 1918. Every one of our Baldwin, Greening and Tompkins King trees started with a very weak growth, yet now they have reached a normal state of vigor and have practically recovered in so far as sapwood injury is concerned. Many orchards out in the State, where the injury as indicated by the

growth at the beginning of the season of 1918 was less than that in our orchard, have not shown anything like such good recovery. In all cases these orchards were not plowed during the summer of 1918 or the plowing was delayed until June. The only orchards, except very young ones, that have shown marked recovery were either plowed in the fall of 1917 or in the very early spring of 1918. Severe pruning of such trees by reducing the initial summer leaf surface should tend to hasten the recovery of the trees, but whether it actually has such an effect or not we cannot say with reference to any fruit except the peach. In case of that fruit, in some years rather severe pruning has seemed to favor better recovery, but in other years it has resulted in the death of the tree. So far as I have observed no harm has ever come from light pruning, such as would be given the trees in an average year, but very severe pruning (dehorning) in spite of its apparent benefits in some years is to be avoided.

The bark is generally more resistant to low temperature than the sapwood; however, bark killing was often found following this severe winter. It is found most commonly at the base of the trunk or at the base of the branches on the inner side. It seems that the bark ripens more slowly in early winter at these points. The injury on the trunk is serious only when it is large enough to go, let us say, one-third of the way around the tree. That at the base of the branches is the more serious because it heals so slowly. Young Northern Spy trees are particularly susceptible to this branch injury, though any trees that grow so upright that the secondary growth is largely on the other side of the branches are susceptible. It seems probable that the reason for the killing is the same as for the slow healing, that is, the slow movement of the material from the leaves, there being fewer leaves on that side of the branch. In fact, I have had a chance to observe Ben Davis and Northwestern trees where the branches had been so caused to droop by the crops borne that the secondary branches were only on the upper side. In that case the bark injury was on the under side of the branch at the base, thus the injury always seems to be greatest on the opposite side of the branch from that containing the most foliage. It is often recommended that this dead bark

be removed very early in order to avoid the danger from heart rot fungus. It should be remembered, however, that the cambium is even more resistant than the bark and may remain alive when both bark and sapwood have been badly killed. In that case a new layer of bark will be formed under this old dead bark if it is not removed. If it is removed, the cambium is likely to be dried out and to die. In our observation in a large percentage of cases the cambium was alive and new bark did form if the old bark was not removed. In practically all cases the cambium was alive at least around the edges of the wound under the dead bark, so leaving the dead bark in practically all cases markedly reduced the size of the wound. When it is considered how slowly these wounds heal and how important it is for the strength of the branch that they be healed, the benefit from leaving this old bark for one summer will be appreciated. It would seem best, then, to delay removing this old bark until the second summer after the trees have been injured, and if there is an area left where the sapwood is exposed to paint that. It seems best, also, to do the same with the dead bark on the trunk.

So far as sapwood killing or complete killing was concerned the most tender variety of apples was the Baldwin. Tompkins King, Rhode Island Greening, Gravenstein, bearing Hubbardston, Stayman Winesap and Esopus were nearly as tender. Ben Davis was more resistant, but it suffered great injury. No injury was found in New York State to either McIntosh or Oldenburg, and Delicious seemed very resistant. Both Fameuse and Wealthy proved less resistant than McIntosh, and Northern Spy was decidedly less resistant.

It should be borne in mind that the killing during the winter of 1917–18 was not determined entirely by the winter. The previous summer was exceedingly short and the wood was not well ripened for winter. Anything that reduced the foliage during the previous summer generally increased the amount of injury; thus, in an average year, the loss of foliage of late summer due to the red hump apple worm has not been considered serious. However, I do not know of a single case where a tree or branch was not killed where the foliage had been removed in this way during the summer of 1917. I saw instances

where heavy pruning by reducing the foliage had increased the injury and where the bark was killed around a wound made by the removal of a branch in the spring of 1917. An excellent example of the effect of severe pruning was seen in an orchard at Pultneyville, New York. Some high-headed Northern Spy trees had been top-worked to Hubbardston. With some of the trees all of the Spy wood had been removed during the summer of 1917, while with others it had not. Of course the removal of the Spy wood reduced the size of the top and the amount of foliage for that year. In all cases where this had been done the bark and sapwood of the trunk were badly killed, the injury being greater the farther away from the foliage on the trunk the tissue was located. In case of the trees where the Spy wood was not removed, there was little such injury. All over the State of New York during that winter lower branches that had lower secondary branches shaded off by upper ones were badly killed. The foliage on these branches of course was very small in proportion to the branch. It seems, then, that something moves downward from the foliage to ripen the wood. An interesting observation was the effect of a heavy crop in the summer of 1917 on the resistance of the wood during the following winter. Trees bearing a heavy crop in nearly all cases were killed much worse than others. It would seem possible, then, that the material from the leaves that would ripen the wood goes instead to the fruit. The crotch injury and trunk injury that we have mentioned above seem to be explained in this way. They are farthest from the foliage and it takes longer for the material to reach them, and in case of the crotch injury there is less foliage on the inner side of the branch from which the material may move.

Killing in the pear was very much like that of the apple except that the pears average more tender. Particularly is the wood more tender in the spurs, thus in most winters in Ithaca we have serious killing of this wood in the spurs. The Bartlett, Angouleme, Bosc, Clairgeau and, generally, Kieffer were among the more tender, while Clapp's Favorite, Anjou, Lawrence and Flemish Beauty were among the more resistant, Flemish Beauty and Anjou being markedly resistant.

Since injury to the peach is quite common and there was nothing peculiar brought out by the year 1917–18, I shall omit any discussion of that here.

One is not able to make recommendations for avoiding or overcoming injury from severe cold as he would be in case of insect or fungous injury. As we have seen, the most important method of enabling the trees to overcome rather severe injury of the wood is good cultivation, that is, either plowing the trees in the fall or very early spring, and where the soil is not very fertile using nitrate of soda. Of course the trees may be so injured that nothing can cause them to recover. In that case the money for the nitrate of soda and for the plowing would be wasted. There is not much advice to be given as to means of avoiding injury through increasing resistance of the trees. If such cold winters always followed short seasons, like that of 1917, then one might be inclined to advise against encouraging too much growth in the case of young trees. However, if the previous summer should be dry in early summer and wet in late summer, then a tree in sod might be in more danger than one receiving good cultivation, for it might receive a check during early summer when it was dry and start a second growth during the wet period following. In that case it might be killed by a rather mild winter. So far as our experience indicates, a tree growing under good cultivation will have its wood in better condition to resist the average winter than one that is not well cultivated, and we have seen that good cultivation will greatly improve its chance to recover even when the injury has been rather severe.

Much has been said about the effect of the killing of so many trees during that winter on the outlook for fruit growing. The number of trees killed was very large, but in so far as the apple is concerned it is probably small compared with the number of trees that will soon be coming into bearing in portions of New York, Virginia, West Virginia, Maryland and other sections. It seems very doubtful if the effect of the number of trees killed during that year in the total crop of the country could ever be measured, since the fluctuations due to other causes was so large.

The Commonwealth of Massachusetts

DEPARTMENT OF AGRICULTURE

DEPARTMENT CIRCULAR No. 25

August, 1920

Supplanting Circular, No. 31, 1915

The Farmer's Interest in Game Protection

EDWARD HOWE FORBUSH

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1920

Publication of this Document
approved by the
Supervisor of Administration.

THE FARMER'S INTEREST IN GAME PROTECTION.

EDWARD HOWE FORBUSH, DIRECTOR, DIVISION OF ORNITHOLOGY, DEPARTMENT OF AGRICULTURE.

Introduction.

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

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

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

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

Economic Value of Game Birds.

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

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

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

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

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

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

The Economic Value of Game Mammals.

The native game mammals of Massachusetts consist of squirrels, hares, commonly called rabbits, and deer. The woodchuck, raccoon, fox and other predatory or destructive mammals, although hunted, are usually classed as vermin by the gamekeeper, but some of them yield valuable fur. Squirrels are of some service as tree planters, for they distribute

the seeds of nut-bearing and cone-bearing trees far and wide; also they destroy insects, for a time, in the summer. Under protection, however, they are likely to so increase in numbers as to become destructive to birds, nuts, fruit and grain. Rabbits, when numerous, destroy young trees; and deer, under the same conditions, attack young fruit trees and vegetables. Therefore the farmer has not the same economic incentive for conserving mammals that he has for protecting birds. Nevertheless, all these animals add to the attractiveness of country life. And if the laws are so framed as to give to the owner of the land an opportunity to protect his property from their inroads, and to take a reasonable number for food, the game mammals may be considered as of considerable value to the farmer.

Financial Benefits derived from Game.

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

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

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

This system has not made much headway in Massachusetts, but farmers who have given it a trial are well satisfied with the result. A number of farmers in southeastern Massachusetts, who have learned the value of the bob-white, find

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

that they can maintain a good stock of these birds by combining, and leasing the shooting rights. Their lands are not much wooded, and are more easily guarded against poachers and trespassers than the wooded lands in some other parts of the State. This may account, in a measure, for their success.

The principal difficulty in finding lessees for shooting rights lies in the scarcity of the game, but this drawback can be remedied. Wherever the game is protected against excessive shooting, and where such natural enemies of the game as lynxes, cats, foxes, raccoons, minks, weasels, rats, crows and bird hawks are held in check by the gamekeeper, the game soon becomes abundant. In some cases it increases so fast that considerable shooting becomes necessary to prevent excessive increase and the consequent spread of infectious diseases, which are very fatal on an overcrowded game preserve. In this latitude the bob-white is sometimes nearly exterminated by severe winters; but much of this excessive mortality might be avoided by giving the birds a little care, protection and food in winter. The woodcock needs only suitable cover and protection. The ruffed grouse or partridge is hardy, and may be made numerous on any preserve which contains good cover and an abundant supply of food. The wooded hillsides of Massachusetts, interspersed with swampy hollows, are the natural paradise for this king of game birds; and there is much rocky and swampy land that is of little value for anything but the production of timber and game. The pinnated grouse or heath hen ought to thrive under protection on much of the sparsely wooded land in southeastern Massachusetts. The increase in the numbers of these birds on Martha's Vineyard since the year 1918 gives hope that they may recover their lost ground. Snipe and certain shore birds gather on any suitable marshes where they are not continually molested, while ducks may be attracted to ponds, streams or fens by a few call or decoy ducks, or by wild rice or a supply of grain for food.

The principal objection urged by the opponents of the system of leasing shooting rights and the establishment of game preserves is that the policy is un-American, and that it

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

If we are to have game in the future, we must regulate hunting strictly, and adopt some system of game preserving, coupled with artificial propagation of game. The policy of licensing hunters, which has gone into effect in New England, will restrict the number of hunters, particularly the alien hunters; and this is a long step in the right direction. Foreigners, who come here without knowledge of our laws and with the idea implanted in their minds that liberty in the new country means license to do as they please, should not be allowed to shoot at all. Aliens now are prohibited from hunting, but even with the alien eliminated from the field there will still remain an army of hunters so vast that, with free shooting allowed, the game will have little chance except in remote regions. In 1919 about 72,000 hunters were licensed in Massachusetts, and the number is constantly increasing.

Under our present system, the only salvation of the game is to prohibit its sale and thus remove the incentive for market shooting. Sale has been forbidden now by law except in the case of rabbits or hares. But with the advent of arti-

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

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

The Artificial Propagation of Game.

The rearing of native upland game birds in confinement is still a subject of experiment, and never has been made a financial success; but enough has been accomplished to prove that it is possible to rear the ruffed grouse, the pinnated grouse and the bob-white in domestication. Mallard ducks, black ducks, wood ducks, teal, Canada geese and a few other species have been reared successfully. When such birds as

wood ducks and Canada geese find a ready market alive at from $10 to $25 a pair, or more, those who understand the business of rearing them ought to make a profit. Pheasants may be sold at similar prices, and at present they will bring profitable returns in some of our markets. Any successful pheasant raiser in Massachusetts ought now to be able to dispose of all the birds that he can rear. If the people take advantage of their opportunity, enough of these birds should be raised by farmers and sportsmen to make them plentiful in our markets. The ring-necked pheasant, which is the species most commonly reared, is not a conspicuous success as a wild game bird in Massachusetts; but it has succeeded better, under the adverse conditions surrounding game birds here, than has any other introduced species. It thrives best, however, if given some care and protection, and it needs to be fed in winter. As a half-domesticated game bird, artificially propagated, protected and fed by man, it is unexcelled. Its general distribution throughout the State under protection is not particularly desirable, for it is liable to diseases that are fatal to native game birds, and where it becomes numerous it is destructive to certain crops, and consumes the food of quail in winter. But if reared in inclosures while young, and allowed to run half wild on the grounds of the owner, it makes a very desirable addition to the supply of game for the table, and therefore will probably take the place in our markets of some of the native game birds now illegally sold.

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

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