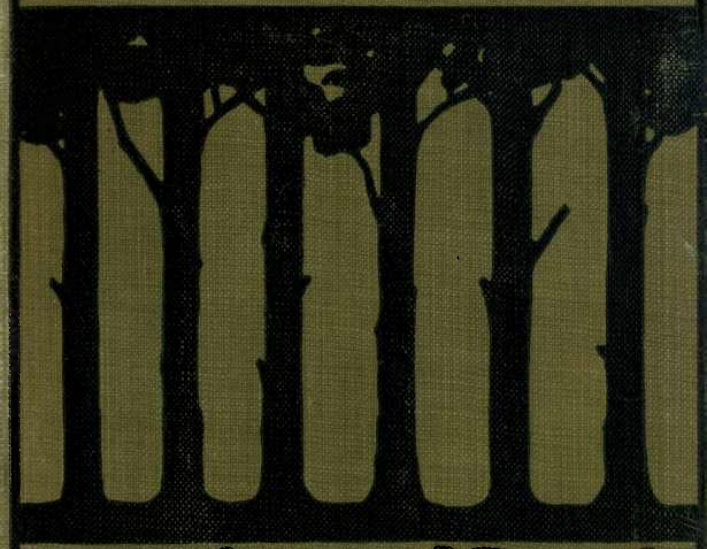
Intensive Farming

by L. C. Corbett



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INTENSIVE FARMING

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A Field of Celery Grown by the "New Celery Culture" Plan

Intensive Farming

BY

L. C. CORBETT

Illustrated

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CHAPTER I

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THE PROBLEM

EACH year more millions of the inhabitants of the United States become dependent upon those who grow the food stuff of the nation. Our population is growing rapidly. There are more people to be fed. There must be an increased harvest to supply this increasing demand. This problem has in the past given us little concern because there were vast areas yet undeveloped. The increased harvest resulted from bringing more acres under cultivation. The population is still increasing at as rapid a rate as formerly, yet the wild lands have for the most part been brought under the plow. The capacity of these soils, under customary methods of agriculture, has been measured and their contribution is now reckoned in our annual harvest.

The problems presented are; (1) a nation with its tillable area under fence and its productive capacity tested; and (2) a rapidly in-

creasing total population and a much more rapidly increasing urban population. A study of our foreign trade relations presents significant facts for consideration in this connection. We have been heavy exporters of grains and bread stuffs, but within the last decade there has been a rapid decline in this respect. In fact, we have ceased to be an important exporting nation. Yet with all this there has been no diminution of the annual harvest, the decline in exports is not to be accounted for by decreased harvest but rather as a result of increased home consumption. We will soon cease to be exporters of bread stuffs, all that our fields produce under present cultural practices will be required to feed our own population.

After this condition has been reached, what then? Shall we decrease the individual ration in order to provide for the increase in population as has been done in China? Or shall we regulate the increase in population to conform to the present producing power of the land? Or shall we demand a more bountiful harvest from our arable areas?

Few will willingly restrict their menu either in variety or quantity in order that an increased population may be fed. The increased attention given to the problems of eugenics indicates that

it is the desire to improve rather than limit the increase in population. The answer to the problem seems to rest, therefore, in increased production from the available areas; in other words, more intensive methods of farming must be adopted in order that the growing population may be properly fed and clothed.

The present movement, "back to the land," will to a limited extent delay the time when the problem of supply and demand will become acute, but come it surely will in this country as it has in the Orient. While there is a decided movement landward our statistics of population clearly show the tremendous increase in town and city population as compared with that of the rural community. If this ratio is maintained the time when demand will outrun supply will be greatly hastened. But the problems of supplying bread and meat are not the only problems in feeding a nation. Grains and meats, under present conditions, can be transported great distances and kept to serve the needs of months and even years.

Not so with vegetables and fruits. The excellence of these products is rapidly lost if stored, and many do not lend themselves to modern cold storage methods, while all that can be stored emphatically determine the length of the period

without intervention of law. Perpetual supplies of fruits and vegetables are now available through the modern art of canning, through cold storage, and by means of rapid transportation combined with cold storage in transit. Rapid transportation and the perfection of the refrigerator car have made it possible to feed the great consuming populations which have in recent years come together in our great cities. The gardens which supply our cities have been extended from the limits of the wagon haul—which determines the operations of the market gardener—to beyond the limits of our own domain. Rapid transportation and refrigeration have made the Southern truck grower a competitor with the Northern greenhouse gardener.

Invention has made it possible for a single individual to easily seed, care for, and harvest the product of 160 acres of land. The whole trend of the times has been to increase and extend the efficiency of the individual. As a result we have built up single crop systems of farming which are at the same time most dangerous, most exhaustive, and least productive per unit area of any type of agriculture known. It is this system of garnering nature's resources upon which we, as a nation, have been depend-

ing to feed our people and create our export trade.

We shall probably continue to extend the area tributary to the great markets, we shall continue to invent labor saving devices, but with all this we are face to face with the problem of increased production from the area under cultivation.

Increased production from a unit area in agriculture, the same as increased production per capita in manufacture, means scientific management.

Scientific management is rapidly being adopted in certain lines of agriculture. The dairy industry furnishes most striking illustrations of this. The recent developments in the production, harvesting, transportation, and marketing of citrus fruits from California marks another signal success of the application of scientific management.

It has been determined that agriculture can be capitalized and scientifically managed quite as readily and with as marked a degree of success as can the building of cars or the manufacture of lumber. In fact, one of the great handicaps to successful agricultural development in the past has been lack of dynamic capital and lack of expert management.

Intensive results demand greater investment in land, equipment, and oversight. Intensive farming, except on the most limited scale, requires a greater expenditure for manures and seeds than is ordinarily provided, a more complete equipment of implements, larger outlay for packages and containers, and higher priced oversight. Intensive farming is not restricted to fruit growing and gardening as is too often supposed, but can be applied to nearly all systems of mixed farming. Intensive farming has for its object the most complete utilization of the soil and the production of maximum yields.

CHAPTER II

VEGETABLE GROWING

VEGETABLE growing offers greater diversity in types of *intensive farming* than any other branch of agriculture. The simplest type of intensive farming is that of the special crop, such as potatoes, onions, celery, or cabbage, grown in connection with other farm crops. This type of farming closely resembles fruit culture, except that in the one case perennial plants are dealt with while in the other the crops are all annuals.

A more complex plan of vegetable growing is that usually employed by the truck farmer, in which the potato and cabbage crops are followed by corn in the same year, spinach by string beans or cucumbers, and where strawberries are grown the first season between rows of potatoes. A still more complicated arrangement is practiced by the market gardener in which closely planted rows of onions, radishes, or lettuce may be placed between rows of po-

tatoes or early cabbage, the onions, radishes, and lettuce going to market in a few weeks, thus clearing the ground so as to give the potatoes or cabbage the whole area. This is followed by planting summer cabbage between the potatoes before they are dug and sowing fall beets, turnips, or beans between the early cabbage before it is ready to harvest. By double cropping and a succession of crops upon the same soil it is practicable to grow four or more crops on the same area in a single season.

Following upon this intensive utilization of the land during the open growing season comes a system in which protective devices are used to lengthen the season and to insure crops when they could not be safely grown in the open. For this purpose hot beds, cold frames, and "muslins" or muslin covered frames are employed. Both double cropping and a succession of crops is resorted to in *frame farming*. The next step in the scale brings the crop within the artificially heated glass structure, where the grower has practically all the factors of plant growth, save that of sunlight, under his control. In the modern forcing house soil, heat, and moisture are absolutely under the management of the gardener, but he cannot make the

sun shine in cloudy weather, and no amount of heat will take its place.

These brief outlines of the general vegetable cropping systems now in common use give a hint of the highly intensive character of the industry.

Potatoes. The potato is an extremely cosmopolitan crop. It has followed the civilized man into almost every quarter of the earth. In the United States there are as many acres devoted to its cultivation as to all other vegetable crops combined and the revenue from the crop is about forty per cent. of the total value of the vegetable products of the country. As a wealth producer it ranks fifth among all the crops of the nation. Furthermore the value of our potato crop alone is considerably greater than that of the combined crop of the tree fruits of the United States.

Notwithstanding the great aggregate value of this crop, the yield per acre for the whole country is far less than that of European countries. There are individual growers in some especially favored localities who produce high yields. In the potato business, however, gross yield is not always a true measure of net returns. Under some conditions it is possible for the gross yield to be in inverse ratio to net re-

turn. Fortunately for the grower this condition seldom actually exists.

Potato growing has come to be a high art within recent years. Expert growers have learned to select their seed by using the "tuber unit" method in combination with the "progeny row" to build up highly productive strains of seed.

The tuber unit method of potato improvement is based on tubers weighing from six to eight ounces, carefuly selected with regard to type, size, and uniformity. As each potato is planted it is cut into four pieces of as nearly the same size as possible by splitting it lengthwise. Each piece is placed from twelve to fourteen inches apart in the row. The next tuber is treated in like manner, a vacant space being left between the four pieces forming any particular tuber. This makes it possible to mark, during the growing season, the groups which are vigorous and free from disease. The most productive of these can be selected at harvest time so that, by two observations, the tubers secured are healthy, vigorous, and productive. The product of the four hills from any particular tuber can be thrown together and retained for next season's planting. The product of any tuber which is carried over and planted

by the tuber unit method in a row the second season constitutes a progeny row.

Under good cultivation yields of four hundred bushels per acre are not at all uncommon where high grade seed is used. Modern machinery has made it possible to handle the crop on an extensive basis at a minimum of cost. The gang plow, the potato planter, the riding cultivator and the potato digger have all combined to lessen man's labor in handling the crop and to lessen the cost of cultivation.

There are two distinctive potato industries in the United States. One is the production at the South of early potatoes for the great city markets. This industry is of comparatively recent origin but has attained immense proportions. Growers plant the crop early in the season, generally using Northern grown seed. This Southern industry, therefore, makes a market for large quantities of seed potatoes grown at the North.

Another peculiarity of the industry is that the tubers are harvested as soon as they are large enough regardless of the stage of maturity of either the tubers themselves or of the vines. Potatoes of this character are highly perishable and must be handled as quickly as other perishable vegetable crops. These truck

crop potatoes occupy the land only a short period, usually from February to June, and are followed by another crop, often corn. Extensive truck growers frequently plant as many as two hundred and fifty or three hundred acres of potatoes. Some idea of the character of the industry may be gained from the fixed charges connected with the production of the crop. Leaving out of consideration the interest on the land and noting only items of direct expenditure, the list will appear somewhat as follows:

Plowing one acre	$ 4.00
Harrowing one acre	.60
Planting (with planter)	1.00
Seed for one acre (12 bu.)	12.00
Fertilizer (1,000 lbs.)	17.50
Cultivating	2.50
Digging	2.00
Packing up 100 bbls.	10.00
Packages, 100 bbls., at 22c	22.00
Covers, 100, at 3c	3.00
Total cost of production	$ 74.00
Transportation, 100 bbls.	$ 35.00
Selling, 10 per cent	20.00
Total expense	$129.00
100 barrels at $2.00 (gross returns)	200.00
Net returns	$ 71.00

The capital required to finance the planting of one hundred acres or more of potatoes is a very considerable sum. The risk involved is

greater with this crop than with most other crops save those grown in greenhouses. The cost of producing this class of potatoes is high but as a rule the returns are satisfactory but not greater than for many other vegetables. The net return from this crop, considering the labor and expense involved, should be greater than it is. Such crops should pay at least one hundred per cent. over cost of production, but the potato by no means averages such a return.

CHAPTER III

ONIONS

THE onion crop of the United States presents a greater variety of cultural practices than any other crop grown outside glass structures. The distribution of the plant is almost universal, but its commercial cultivation, while by no means universal, is localized in regions possessing a wide diversity of climatic conditions. The soils upon which onions are grown vary much less than the climate and the cultural practices.

The onion industry is chiefly concerned with the production of mature bulbs for human consumption. A large portion of the labor expended upon this crop is for the production of such bulbs, and the chief return from the industry is derived from their sale.

The production of mature bulbs for human consumption rests upon two general practices: First, sowing the seed in place early in the season where the bulbs are to mature, and, Second, sowing the seed in especially prepared

Photo by Beattie

Intensive Agriculture as Seen in an Onion Field

seedbeds, sometimes hotbeds or cold frames, and transplanting the young plants to the field. By far the greater portion of the onion crop produced in the Ohio Valley, the Eastern states, and California is grown from seed sown in place.

Many market gardeners, however, practice the "New Onion Culture," i. e. transplanting from the hotbed or seedbed. The extensive use of this method is found, though, in connection with the Texas Bermuda Onion industry. This industry is carried on almost exclusively by the transplanting method.

In the North where the transplanting method is employed the Prizetaker type of onion is almost universally grown. This is a soft, tender long season type. By starting the seedlings in hotbeds in February or March several weeks are added to the growing season. The bulbs grow larger, a perfect stand of plants is insured and as a consequence a maximum yield per acre is secured.

Another interesting onion industry is that of growing "sets," small bulbs which are grown from seed scattered thickly so that the young plants crowd one another severely, thus causing them to ripen prematurely after forming a small yet very perfect bulb. While this industry

is localized in three or four sections of the country, it differs markedly from other types of onion growing and is at the same time highly remunerative.

This leads to a consideration of the green bunch onion industry. Onion sets while used to a limited extent for the purpose of producing mature edible bulbs, are chiefly used for the production of early green bunch onions. Market gardeners in the vicinity of every large town and city grow a quantity of early bunch onions, either from sets grown from seed as above described or from another class of onions known as Potato Onions or "Multipliers." Potato Onions are hardier than most varieties grown as sets from seeds. The Potato Onion perpetuates itself chiefly by subdivision of the large bulbs, each large bulb splitting up into a number of smaller ones, each of which is planted out to be harvested for green bunching or allowed to grow to maturity to be used next season to increase the planting stock by again splitting up into several bulbs.

There is yet another class of onions used for this purpose, known by various names as "top onions," "top sets," multipliers, etc., all of which produce tiny bulblets at the top of a seed stalk. Sometimes, seeds and bulblets are

produced on the same head. These sets or bulblets are carried through the winter in a dry state, the same as ordinary sets grown from seed, and are planted out early the following spring, while Potato Onions are usually planted in the autumn, and in those localities where they need winter protection mulched with straw or coarse litter.

Onion culture is carried on as a successful commercial industry chiefly in the states north of the Ohio River and east of the Mississippi. The industry also thrives in certain districts in each of the states bordering the Pacific, where the crop frequently is grown on irrigated land. The delta region of the mouth of the Mississippi has long been noted for the production of a peculiar type of onions, grown little in any other section of the United States, known as the Creole Onion.

Of late years the Bermuda onion has been extensively planted as an autumn crop on the irrigated lands in Southwest Texas and the valley of the Rio Grande River.

It has recently been determined, through the work of the United States Department of Agriculture, that the large mild flavored Denia or Spanish onions, so extensively imported into this country, can be successfully grown in cer-

tain portions of Texas, Arizona, and New Mexico, and without doubt in Southern California.

Onion culture is not confined to humid sections, although a great and profitable crop is grown in this portion of our domain. Certain varieties attain the highest perfection when grown, during the winter months, under irrigation, in the semi-tropical portions of the United States.

Onion Seed Growing. Onion seed is successfully grown in several sections of the continent. Early in our history the seed was produced in the New England states, and a small seed industry has ever since been maintained in that section. Some of our most successful commercial sorts have been originated in the Danvers section, from which they have derived their name. A commercial onion seed industry also exists in northeast Ohio, northwestern Pennsylvania, and western New York, but the chief source of supply is the California seed fields. In the vicinity of San José, California, hundreds of acres of bulbs are planted each autumn for the production of seed. Most sorts thrive in the region and produce seed suitable for general commercial purposes.

The seed supply for the Bermuda onion industry has not been commercially produced in

the United States. It can be grown in California but is not satisfactory. A little seed has been produced in Texas but the yield is low and the crop uncertain. The supply of seed for this branch of the industry will for some time, without doubt, continue to be imported from Teneriffe.

Storage. Onions are not as highly perishable as some of the other important vegetable products. Green bunch onions are equally as perishable as other green vegetables, and Bermuda onions are not adapted to storage as are some other types of mature bulbs. The main crop of bulbs grown from black seed, such as the various Danvers, Southport Globe, and Weathersfield, can all be kept for several months under proper storage conditions. This, together with the fact that onions of all classes, save green bunch stock, can be safely shipped long distances to market, renders the crop one of the most satisfactory of the vegetable list. These qualities are a great advantage in the handling and marketing of any crop. It is possible, with a crop possessing such qualities, to select the time for marketing, as well as the market to which it will be offered. With highly perishable products no delays are possible. The onion crop on the other hand does

not have to be forced upon the market in mass at harvest time. Gluts and consequent depression of prices can be averted. The grower, if prepared to store his crop at harvest time, can gain the advantage of any advance in price which otherwise might go to the speculator.

Yields of onions vary with the soil, the season, culture given, and variety grown from one hundred and fifty to six hundred bushels per acre for such sorts as Yellow Globe and Red Weathersfield, and from 12,000 pounds to as high as 48,000 pounds per acre for Bermuda onions. The average for the Weathersfield class is about three hundred bushels per acre, while the average for the Bermuda type is about 20,000 pounds per acre.

The average gross income for the Northern field crop is about $150.00 per acre, with maximum returns under high prices of $400.00 per acre. The Bermuda crop returns from $300.00 to $400.00 per acre, depending upon the price. Banner yields and high prices have returned as high as $1,200.00 per acre. As compared with cereal crops onions produce from six to fifteen times as much gross return, but it must be remembered that the cost of production is much higher. The land adapted to the crop is restricted in area, is more valuable, is more

expensive to prepare, and requires more liberal use of expensive fertilizers. The seed is more expensive and the cultivation and harvesting also more costly.

While all the fixed charges for intensive crops are higher than for cereals they are not sufficiently high to reduce the net profits to the same level as those for cereals.

A comparative accounting between onions and corn, both hoe crops, would appear somewhat as follows:

	Corn	*Onions*
Interest on land	$ 2.00	$ 6.00
Cost of preparation	3.00	6.00
Cost of seed	.25	8.00
Cost of planting	1.00	3.00
Cost of cultivation	1.00	15.00
Cost of harvesting	2.50	10.00
Cost of fertilizer	.00	40.00
	9.75	88.00
Market Value of Crop:		400 bu. at 50c=
50 bu. at 70c=	35.00	200.00
Net returns	$25.25	$112.00

The net return from the onions is almost five times as much as from corn, but the cost of producing the onions is about *nine* times as as great. More capital and more knowledge are required to grow the onion crop but it pays.

CHAPTER IV

CELERY

CELERY is one of the most remunerative vegetable crops. Its commercial cultivation, however, is restricted to localities possessing a combination of soil and climatic factors peculiarly suited for it. It is naturally a cool climate moisture-loving vegetable. It thrives best on thoroughly subdued swamp muck lands,—lands rich in organic matter, sufficiently decayed to have an abundance of available plant food, and with the water table within eighteen inches or two feet of the surface. Lands of this character, at the North, within hauling or shipping distance of the markets have for many years been devoted to the production of this crop.

Such locations were unable to produce a merchantable crop before July and under best storage conditions the crop was not available later than March. This territory was able to supply the market from July until March or for about eight months. The remainder of the

year the markets were bare of this most delicate and appetizing vegetable.

It was found by taking advantage of the cooler portions of the year that soils in Southern California, in the Sacramento Valley, and in Florida could be made to produce certain types of celery to a high degree of perfection and that this product could be brought upon the market to supplement the supply from the Northern fields and to extend the season.

The advances made in the handling of perishable freight have been one of the chief factors contributing to the commercial success of celery culture in both California and Florida. Fortunately celery is not so highly perishable as some of the vegetable crops now grown and successfully transported to distant markets, but its bulk restricts the shipment by express and its perishability prohibits the use of slow freight.

Besides the factors already mentioned, the extension of the celery business has been greatly benefited by a variety list possessing well marked types particularly adapted to different systems of cultivation.

The dwarf self-blanching types represented by White Plume and Golden Self-blanching are peculiarly suited for climatic and shipping con-

ditions which preclude the use of earth in blanching the crop for market.

For the most part the early crop of the North is blanched with boards or paper, as earth can not be successfully used during the heated portion of the year. If earth is used great care and caution are required on the part of the grower. The late crop at the North, whether standard or dwarf sorts are used, is always blanched with earth. In Florida the entire crop is blanched either by means of boards or paper. Besides the advantages already mentioned a greater number of stalks can be grown per acre when dwarf sorts are used than when standard green varieties are used. Blanching with boards or paper permits the rows to be placed at about one-half the distance required when earth is used for blanching; this also increases the intensity of the crop. Celery is sold by the dozen bunches. The profit per acre depends, therefore, not only upon the price per dozen but upon the number of dozens produced.

During recent years the hotel and dining car trade has been demanding small celery. The small heart stalks are most desirable and this has tended to stimulate close planting and the use of dwarf sorts. These demands of the trade will ever tend to keep the celery industry

on a mediocre basis for the reason that the highest quality is not attainable in the dwarf self-blanching types. The acme of perfection as regards quality, texture, and flavor are obtained only in the standard green sorts produced under mild temperature conditions and by the use of earth for blanching.

Another important element in the success of the celery industry has been added in recent years through the control of the celery blight. Celery blight is the most serious trouble with which celery growers have to contend. It is one of those insidious plant diseases always lurking about and ready to devastate the crop at any stage of its development. Like all other plant diseases its treatment is from the standpoint of prevention rather than cure. The grower should therefore take precautions to prevent its gaining a foothold in the seedbed by spraying the young plants frequently with Bordeaux Mixture. Only healthy plants that have been grown without check should be set in the field.

The removal from seedbed to field should be accomplished in such manner as to give the least possible check or shock to the young plants. If the area cannot be irrigated, transplanting should be done at a time of day to

favor the plants and prevent flagging. Weather conditions should be taken advantage of as far as possible. If the season is showery it should be the aim to transplant to the field either in the evening or just before a shower. In localities where natural conditions cannot be readily taken advantage of at transplanting time the plants should be severely pruned and the roots puddled in order to insure the least possible check to the plants. If the industry is conducted on a small acreage it is often advantageous to install a sprinkler system for starting the young plants, particularly if the crop is in a rotation with others upon which the sprinkler system of watering can be safely used.

If the crop is grown on an extensive scale in a region where irrigation is essential to the greatest success it will be found advisable to provide facilities which will enable the water to be supplied by means of ditches and furrows between the rows rather than by the sprinkler system. A large quantity of water can be applied within a given time and the foliage need not be wet, a very important consideration in the control of celery blight. It is much more difficult to control celery blight during showery weather than during dry weather. Any prac-

tice, therefore, which produces conditions similar to those during showery weather increases the risk of crop production. Every factor of cultivation, should so far as possible, be an element in crop insurance. The important elements of crop insurance in celery culture are: First, *good seed;* second, carefully grown and transplanted plants; third, thorough spraying for control of blight and other diseases; fourth, irrigation of such a character as not to counteract the effects of the spray and yet sufficient to insure the crop against adverse climatic conditions.

The two factors which, more than any others, determine the hollowness or pithiness in celery are *seed* and checks to growth either in the seedbed or field. Poor seed may be responsible for hollow stalks, but a severe check to the plants in the seedbed, at the time of transplanting, or during the growing period in the field may cause either hollow stalk or pithiness. The utmost care should be used to guard against such adverse conditions.

Plants with hollow stalks resulting from bad seed have young heart stalks as well as the older leaf stalks hollow, while in the hollowness or pithiness resulting from adverse conditions the young heart stalks will be solid, and

under favorable treatment the crop may grow out of the condition.

From what has been stated the factors which control the aggregate profit per acre from growing celery in any given locality can be determined.

The cost of production and the profits per acre for the different systems will be somewhat as follows:

	Plants 6 in. apart in rows		
	Fifteen inches apart	Three feet apart	Double rows 6 ft. apart
Interest on investment in land	$ 20.00	$ 20.00	$ 20.00
Interest on equipment	30.00	15.00	15.00
Depreciation of equipment, including blanching boards	30.00	25.00	20.00
Cost of preparation of land	8.00	8.00	8.00
Cost of fertilizer	60.00	40.00	40.00
Cost of growing plants	20.00	10.00	10.00
Cost of transplanting plants	20.00	10.00	10.00
Cost of cultivation, including hand work	15.00	10.00	10.00
Cost of blanching—labor	25.00	15.00	15.00
Cost of harvesting	25.00	15.00	15.00
Cost of crates	75.00	40.00	40.00
Transportation, 25c per crate	125.00	65.00	65.00
	$453.00	$273.00	$268.00
Average crop will return bunches per acre	5,000 to 7,000	2,500 to 3,500	2,500 to 3,500
Average crop will return crates per acre	500-600	200-300	200-300

Gross return at 20c per dozen	$1,000 to $1,400	$500 to $700	$500 to $700
Net return	$547 to $947	$227 to $427	$232 to $432

Since celery lends itself to a variety of systems of growing it can, under favorable conditions of soil and climate, be made one of the most profitable garden crops. The so-called "New Celery Culture," is a plan of growing self-blanching varieties so that no artificial materials such as boards, paper, or tiles are used for blanching purposes. This plan does away with horse cultivation and permits placing an enormous number of plants on an acre. The field is laid off in beds sixteen feet wide and the plants are set in squares eight or ten inches apart each way. Narrow walks are maintained between the beds and as the plants approach maturity boards are placed close to the outside rows of plants on either side of the walk as shown in frontispiece. These boards hold the plants in an upright position and assist in blanching the plants of these rows. The blanching of the plants in the remaining portion of the beds is accomplished by the shade cast by the heavy foliage of the plants themselves.

On a limited area with very fertile soil and pro-

visions for sub-irrigation this system of cultivation can be made highly profitable.

Considering the fact that such a great number of plants can be grown by the "New Culture System" and that a system of double cropping will permit growing both an early and a late crop on the soil during the same season, the crop is especially attractive from the growers point of view.

To grow the early and late crop on the same area it is necessary to plant two sorts in alternate rows three feet apart. By using Golden Self-blanching or White Plume for the early crop and Giant Pascal or Boston Market for the late, the alternate rows of the early sort can be blanched with boards or paper as soon as large enough and by marketing it immediately the ground can be cleared in time to make the earth between the six foot rows in which the late sort stands available for blanching it as much as is desirable before placing it in storage.

Few other vegetable crops lend themselves to culture under such extremes of latitude, to both early and late planting. to long distance shipment, and to winter storage as does celery.

Photo by Beattie

A Field of Earth-Blanched Celery

CHAPTER V

FRAME CULTURE

WHILE the use of *cloches* or hand glasses which forms such an important factor in French gardening has never become a part of the American system of culture, chiefly because of the difference in climatic conditions between the two countries, frame culture has grown to important commercial proportions not only in the leading market garden sections adjacent to the large cities, but in other favored localities where climatic conditions and transportation facilities are such as to foster the practice. Near many of the Northern cities the use of both hotbeds and cold frames have long been an important feature of the work of the market gardener. They are used not only for lengthening the season by starting the plants earlier than they could be produced in the open ground, but for actually growing crops to a marketable stage of maturity.

The frame industry antedates the greenhouse

industry. But it is within comparatively recent years that the frame covered with a sash or with muslin has come to be an important factor in crop production at various points along the Atlantic seaboard south of Baltimore. The favorable soil and climatic conditions which exist there permit the development of this industry at all points favored with suitable transportation.

The frame industry is a notable example of a high class of crop insurance, an insurance which makes man master of all the factors of plant growth save light and extreme cold. By the use of frames the danger of injury from frost, wind, storm, or drouth are eliminated. Frame crops suffer only from severe cold (not usual in the region) or lack of sunshine. This, therefore, places it among the highly intensive systems of farming. Intensive farming returns large yields from restricted areas. Frame culture produces large yields from limited areas, and therefore conforms to the definition of intensive cultivation. It is also intensive because some of the uncertain factors of ordinary methods of crop production have been eliminated. The more nearly crop production can be made to approach the art of manufacturing the more intensive (certain) it becomes.

All forms of crop insurance tend to intensify the industry, while all devices and methods of culture which tend to insure or make a crop more certain add to the cost of production, yet as a rule such methods pay a large return on the investment.

Frame culture not only insures the crop, but rewards the grower by high quality. The greater the extent to which a crop is protected against adverse conditions, the more delicate and refined will be its product. Lettuce grown on rich land covered by a good frame is more delicate in texture and flavor than the same variety grown in the open.

The frame at the South serves, in great measure, the function of the greenhouse at the North. The important frame crops are lettuce, beets, radishes, parsley, and cucumbers, all of which figure largely in the forcing house products at the North. Frame culture, besides insuring the crop, makes it possible to grow crops with success at a season when they could not be produced in the open. The land is made to return larger crops and more of them and is kept in profitable service for a longer period. An individual illustration of the practices of a frame grower will be sufficient for the whole industry.

A successful frame grower's area appears to be limited to about three acres. With this area and two thousand sash, an adequate water supply, and plenty of manure—two or three car loads per acre annually—it is possible to secure satisfactory results provided the project is launched under favorable soil and climatic conditions and the man is endowed with ambition and good sense. Intensive work of this kind will prove one of the quickest roads to ruin for the careless or indifferent cultivator. The investment is large and the risks involved are exceeded only by those of the greenhouse operator. There is, therefore, no provision for errors. A carefully planned and managed frame yard will, however, produce a yearly gross return of from $2,000.00 to $3,000.00 per acre.

The returns will vary greatly from year to year, but in the main they will be satisfactory. I have known large yards to yield a $1,000.00 crop of lettuce in the autumn, another equally valuable crop of lettuce in the spring, and a $300.00 crop of beans following the spring lettuce and a crop of cow peas during the summer. In another case lettuce returned $1,000.00 per acre in the autumn, a like return in the early spring, and this crop was followed by trans-

planted cucumbers which had been started in in a hotbed which in turn brought a return of $1,000.00 per acre, $3,000.00 per acre from September to July, without greenhouses but with manure, frames, good soil, and *brains.*

CHAPTER VI

THE VEGETABLE FORCING INDUSTRY

BEFORE there was an important commercial vegetable industry at the South, there grew up a demand for crisp fresh vegetables out of season. The gardeners about the larger towns and cities of the North felt this demand and set about meeting it as best they could by means of hotbeds and cold frames, but these were makeshifts at best and, although successful for certain seasons of the year, they left a long interval during midwinter when the markets were bare of fresh garden products.

As a result of the perfection of appliances for heating glass structures, both by hot water and by steam, it became possible to heat large greenhouses satisfactorily. About this time the clumsy frame structure, covered by movable sash, gave way to the sash bar construction and the modern forcing house was evolved. Small glasses were replaced by large ones, ventilating apparatus came into general use, and the gardener became master of the ele-

ments and the winter production of vegetables as well.

By this evolutionary movement the vegetable forcing industry came into existence. From a small beginning with crops which had been grown in frames, such as lettuce and radishes, the industry and the special varieties upon which it is based have been developed.

Since the beginning of the vegetable forcing industry, transportation changes have made it possible to profitably operate commercial vegetable gardens and farms in the extreme southern part of our country and successfully transport the product to the cities of the North. In the beginning the forcing house had no competition from this Southern field and even now there is a trade which is willing to pay a slight premium for the forcing house product. The difference in price between the forcing house product and the Southern product is not sufficient either in amount or constancy to give the forcing house crop a decided advantage.

The art of growing vegetables under glass has been perfected to a degree which permits the Northern greenhouse grower to compete sucessfully with the Southern fields. The home grower has a slight advantage in special delivery and freshness and this together with the

cost of transportation and the factors of crop insurance necessary at the South evens up matters to such an extent that the forcing house product can be produced at a profit.

The list of crops commercially grown in forcing houses is by no means an extended one. For the most part lettuce, cucumbers, tomatoes, and radishes are the crops grown and their relative importance is in the order in which they are named.

As a rule the vegetable forcing houses of the Eastern United States are devoted to lettuce during the autumn and winter, while in the spring they may be used for either cucumbers or tomatoes. Radishes and beet greens are often grown as catch crops with tomatoes or cucumbers.

Lettuce is the most important and at the same time the most profitable crop grown by gardeners under glass. The glass area devoted to vegetable forcing has for the most part been erected for growing this crop. The methods of handling the crop have been so systematized that a maximum of crop can be produced in a minimum of time and space.

The seedbed occupies only a small area in the nursery. The young seedlings are transplanted to occupy only about one-fourth the

Photo by Beattie

A Block of Outdoor-Grown Head Lettuce

space in the nursery that they require in the growing house. One nursery can be so operated as to supply four houses of equal area, all to be planted at the same time, but as the crops are required in succession one nursery can be operated so as to supply plants for six or eight times its area of growing space. This, together with the short season required in the growing house, makes this crop the most intensive vegetable crop grown. It is possible to grow two crops of lettuce and one of cucumbers or tomatoes and a catch crop of radishes or beet greens in each house annually, four crops on the same soil in the latitude of Boston. This is surely real estate boomer's literature, but it is the truth.

There are two kinds of lettuce grown in forcing houses, head lettuce and bunch or cutting lettuce. The head lettuce is also extensively grown in the open both at the North and in Florida and as a frame crop in the Carolinas and in Virginia. The forcing house production of this type of lettuce is confined to the Atlantic seaboard, the environs of Boston being the center of greatest production. In fact, most of the important American varieties of this type of lettuce have been produced in this locality.

Head lettuce when grown in forcing house

or frame requires to be planted in squares from nine by nine inches to twelve by twelve inches, depending upon the soil and sort grown. At nine by nine inches there are 77,440 plants per acre and at twelve by twelve inches 43,560 plants per acre. It should be possible to maintain practically a perfect stand of plants either in the house or frame, and at the rate of thirty-five cents per dozen or three cents per head the gross income per crop per acre is $2,323.20 for the closely planted and $1,306.80 for the wider spaced plants.

It is thus seen that in handling so intensive a crop as this, the distance at which the plants are placed, other things being equal, measures to a great degree the profit which may be derived from a crop. In fact, potato growers who study their business have long since discovered that there is a limit in both directions on the interval between rows and the distance between the hills in a row. Maximum yield and profitable production are both dependent upon these factors and what is true with potatoes is much more apparent with the more valuable crops like lettuce.

Another type of lettuce is also grown on an extensive scale in forcing structures in the territory north and west of the Ohio River. This

is a loose, nonheading lettuce, known as bunch or cutting lettuce. It is distinctively a forcing lettuce. The Grand Rapids Forcing was originated under forcing house conditions and thrives in that environment better than in the open, although the Simpson, which is undoubtedly the parent stock, thrives well in the open.

The loose lettuce forcing industry is conducted precisely the same as the head lettuce industry so far as propagation and transplanting the young plants are concerned. The Grand Rapids type, however, will thrive and produce a satisfactory crop at much closer intervals than the heading type. The plants are, therefore, set closer, each grower varying the planting distance to suit his market and conditons. Another important respect in which this industry differs from the other is in the general method of marketing.

Grand Rapids is almost universally sold by the pound instead of by the count as in the case of head lettuce. This has advantages as well as disadvantages. The advantage is that the crop can usually be disposed of with equal ease while the plants are yet small or after they have attained their maximum growth. The great disadvantage is that the growers do not exercise the care in growing the crop that would

be necessary were it sold on size and condition rather than by the pound.

In the region where loose lettuce is grown the tomato is a more popular companion crop than cucumbers, although both are used.

Tomatoes. As has already been pointed out, tomatoes are as a rule grown as a rotation crop with lettuce. This is not true in all cases, for some growers have provided special equipment for the crop. In fact, until the modern general purpose vegetable forcing house was evolved special equipment was necessary for forcing the tomato. The modern house answers well for lettuce, cucumbers, and tomatoes as rotation crops. When tomatoes are grown as a forcing crop during midwinter at the North best results are obtained when bottom heat can be applied. This requires special equipment, as the modern vegetable house is not designed for bottom heat. At the time of the year when the crop is usually grown in rotation with lettuce, the sun heat is increasing instead of waning and bottom heat is of less consequence to the development of the crop.

The winter tomato crop at the South has more seriously affected the forced crop of tomatoes than has the lettuce crop of the South the forced crop of lettuce. Notwithstanding

this, many growers at the North maintain that the Southern crop is no menace to their spring house grown crop. There is truth in this argument without doubt, because the quality of tomatoes ripened off the vine, as fruits transported long distances must be, is not as high as tomatoes ripened normally on the vine. The advantage of the house grown fruit is known only to the enlightened buyer. In other words, the forcing house product has an advantage only on a discriminating market.

It is upon a discriminating market more than any single factor that the future of the forcing industry depends. Every forcing crop should possess some visible distinguishing mark. The forcing house tomato should be distinctive in size, color, shape, and method of marketing. It should not be a legitimate competitor of the outdoor grown tomato. When so handled it will appeal to a special trade and command a higher price. People should not be left to find these points of merit for themselves. The grower who is to succeed with high grade specialties of this character must use the same methods as others introducing or extending the sale of their products. Greenhouse products are as legitimate subjects for advertising as a breakfast food or a cracker.

At the outset, by some fortunate coincidence, forcing house tomatoes were sold by the pound, the only sane standard of measure for any food product. The outdoor crop, save that grown at the South during the winter, has always been sold in the Northern markets by capacity measures. In this respect at least the markets have observed distinction between the regular season and the forced crop. This is not enough, the other points of distinction above pointed out should be developed and brought to the attention of the purchaser.

In comparison with the outdoor crop forcing house tomatoes sell for ten to fifteen times as much. A good price for outdoor tomatoes is one or two cents per pound, while forcing house fruit sells for from fifteen to twenty-five cents per pound.

Greenhouse tomatoes, trained to the single stem, should produce an average of five to six pounds per plant and such plants can be successfully grown when planted eighteen by eighteen inches or about 660 plants to each 1,000 square feet of house area. Six hundred plants at five pounds each equals 3,000 pounds from 1,000 square feet or from a space of ten by one hundred feet. Three thousand pounds at fifteen cents equals $450.00. At the same rate

a house thirty-three feet wide and one hundred feet long should return $1,350.00 per season, or as much more as the increased price figures.

Success in tomato growing under glass depends largely upon the skill and care of the operator. There are few insect pests to be guarded against, but there are other enemies, particularly nematodes, or eelworms, which are very destructive. Fortunately, however, these * pests are easily controlled by soil sterilization. This can be accomplished in a variety of ways, by forcing live steam through perforated pipes buried in the soil of the benches, by using drain tile for the same purpose or by using an inverted pan over the area, or in still another way by cooking the soil before placing it in the benches in a specially prepared sterilizer. Any one of these systems when well executed will be effective. Besides these root worms which cause swellings upon the roots of the plants and interfere with their normal functions, there are other serious plant troubles to be guarded against.

The tomato blight, which is a serious disease in the field under some conditions, is also a menace to the house grown crop. This trouble

*See "Garden Farming" for details of soil sterilization.

appears as velvety brown spots on the under surface of the leaves and if not immediately checked it will spread through the house and destroy the crop. It causes the leaves affected to turn yellow, then brown, and finally to dry up. It can be controlled by spraying the plants with ammoniacal carbonate of copper or by Bordeaux mixture. Vigilance and quick action are the price of control of this disease. The difficulties are not insurmountable and the successful crop is a profitable one.

In growing vegetables under glass agriculture reaches its highest perfection. In the forcing house the grower has complete control of more factors of crop production than under any other conditions. In fact, the only factor not under his control is sunlight. The grower regulates more completely than in any other type of agriculture the mechanical character of the soil, its fertility, its water content, its heat, and the temperature and humidity of the atmosphere. The sunlight is beyond his control save in so far as he is able to take advantage of those localities having the greatest amount of sunshine during the forcing season.

Cucumbers. The cucumber is one of the more important members of the forcing colony. As a rule, they occupy the houses at the close

of the season prolonging the use of the houses well into the hot weather, long after such crops as lettuce, cauliflower, and radishes must be abandoned on account of their heat requirements. For this reason the cucumber becomes a very important member of the group. The tomato is its only rival for greenhouse space at the season. At the extreme Southern limit of the vegetable forcing industry cucumbers are grown as the only greenhouse crop. At the North, however, they are almost universally used after the third crop of lettuce.

At the season at which cucumbers occupy the greenhouse, following lettuce as they usually do, little expense is required in maintaining the temperature. Care is essential, however, to see that the plants never suffer from sudden changes or from cold. Like tomatoes, cucumbers require higher heat than lettuce. A day temperature from 70° to 75° F. and a night temperature never lower than 60° F. is desirable. Unless conditions are favorable for the entrance of insects, attention to pollination will be necessary. This can be most economically accomplished by placing a stand of honey bees in the house if it be an extensive one. A small bed can be hand pollinated. In no event should this detail be neglected. Well-grown green-

house cucumbers usually command a remnuerative price, but poor stock is never profitable.*

* For detailed information on the forcing and field cultivation of vegetables, see the writer's "Garden Farming."

CHAPTER VII

FRUIT GROWING

THE APPLE INDUSTRY as at present conducted, under scientific management, is an extensive industry of a high order. Unlike many of the other crops returning a liberal profit, the apple is not restricted to a single use or to a limited season, two marked advantages in its favor.

Non-restrictive season. The large number of good varieties now in cultivation, ranging in season from very early to late-maturing, long-keeping sorts, render the apple in these days of cold storage a year-round fruit. By taking advantage of the variety list and modern cold storage facilities it is possible to handle the apple crop so as to keep the market supplied at all times without glut and at the same time not sacrifice the product. This was not possible a few years ago.

Transportation facilities were not adequate for handling highly perishable products at great

distances from the market. Cold storage was not available for extending the market period and as a consequence all the so-called winter apples were forced upon the market in a few weeks, causing great depression of prices and apparent over production. The period for distribution was limited to the time the apples would keep under more or less indifferent warehouse conditions, a period which at best did not extend beyond the following March. Under these conditions the apple business could easily be over done, the market glutted, and prices depressed. The apple under these circumstances was not available from March until July. For one-third of the year the market was bare of this most popular fruit.

The adaptation of cold storage to the needs of this industry has extended the period for distribution to include the three months which were before lost. The economic effect of this change in the period of distribution on the crop can easily be imagined. Not only has the market period been modified and extended by cold storage but the losses incident to the indifferent methods and conditions of the old warehouse system have largely been eliminated. Storage losses are less, the keeping period of varieties is now well understood, and the trained

dealer knows how to buy in order to have varieties for all seasons.

The large cold storage warehouse to be found in all towns and cities of any considerable size makes it possible for producers as well as dealers to store their stock at reasonable rates. This device of the trade tends to equalize both the distribution and the sale of the product. The fruit does not all pass out of the hands of the producer at harvest time. Many growers place it either in their own storage houses or ship it to the cities to be stored in commercial cold storage warehouses. This tends to maintain better prices at harvest and often results in a good profit to the grower later in the season.

Through the invention of the gravity brine circulating system for cold storage high class refrigeration is available to every orchardist operating in a territory where an abundant supply of natural ice can be harvested or where manufactured ice can be had at small cost. The great advantage of cold storage lies in the possibility of subjecting the fruit to a temperature, as soon as it is harvested, which arrests ripening and makes it possible, by maintaining a temperature low enough to prevent the growth of fungi and rots, to keep the fruit much longer.

The improved methods of handling the fruit

during the growing season result not only in more high grade fruit but fruit which will keep longer. Spraying for insects and diseases, when properly done, produces a larger percentage of perfect fruits. Perfect fruits keep better than imperfect ones because rot and moulds cannot gain entrance. Imperfections, bruises, and injuries of all sorts shorten the keeping period of the fruit no matter how perfect the system of storage. To state the matter tersely, by the proper choice of varieties combined with modern methods of culture, including spraying, and by proper handling and storage, the apple becomes a year-round crop.

Our present knowledge of varieties, soil, cultural requirements, spraying, harvesting, packing, and storage of the apple has reduced its production to an exact science, and so far as the factors over which man has direct control are concerned the industry is on a certain basis. The production of all agricultural crops, in the open, involves several uncertain factors over which man has no control, such as frosts, winds, sunshine, and storms, These risks are greater in certain localities than in others. The greater the risk the greater the possibility of loss. The wise planter will choose his location so as to avoid every possible uncertainty and obtain

every possible advantage. The destruction of the crop by late spring frosts can be guarded against by the use of the orchard heater, and localities subject to frequent late frosts can be utilized for fruit growing, but the cost of such protection adds an important item to the fixed charges or cost of production. Frost free localities eliminate this charge and thus have an advantage.

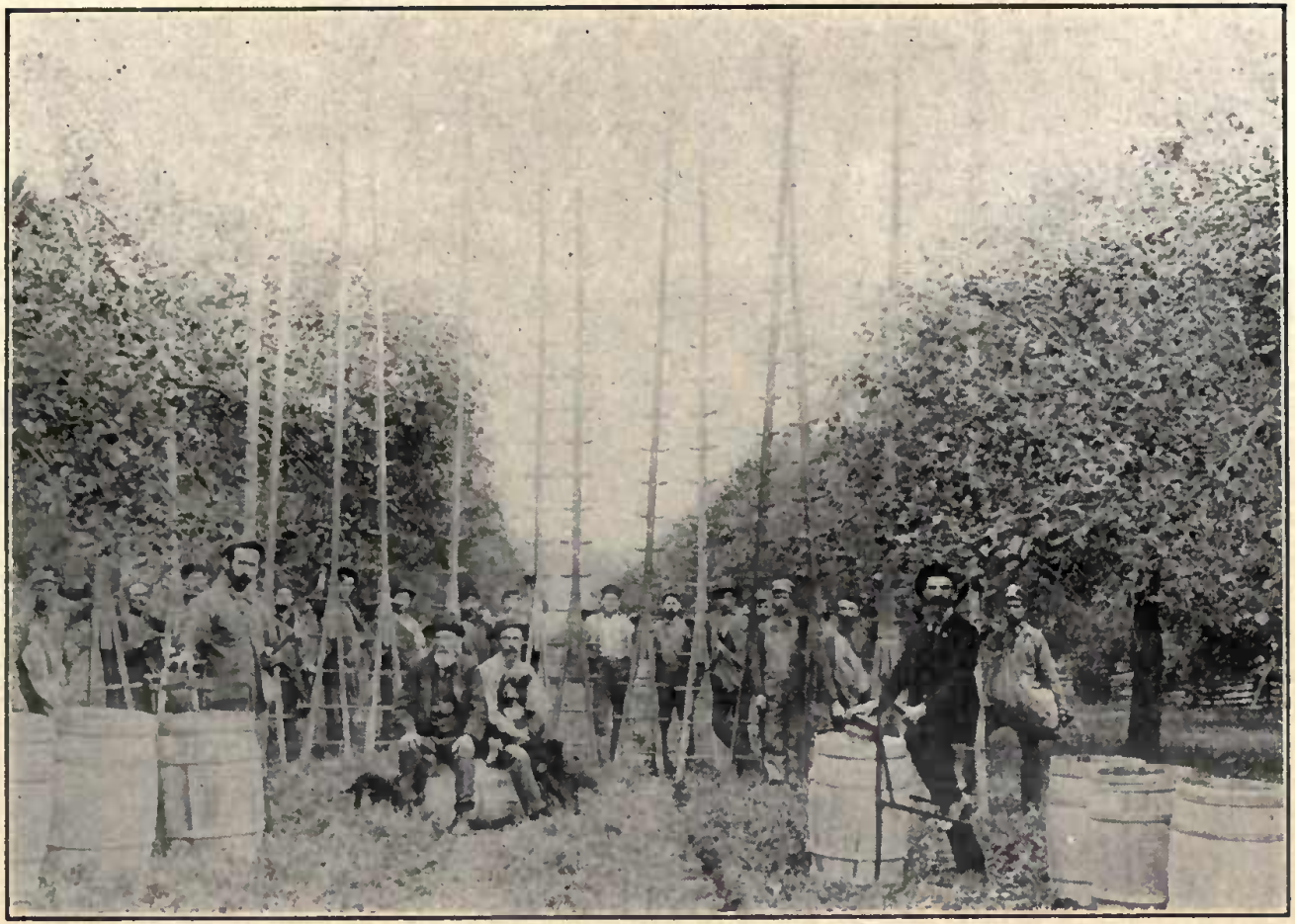
Certain soil and climatic conditions produce modifications in size, shape, color, and quality in apples which sooner or later the discriminating buyers will recognize. In dry climates where the trees are grown under irrigation, the skin of the apple is tougher and the colors more highly developed than in the humid climates. The flesh of the fruit, however, is dryer and its flavor less highly developed in the dry than in the humid regions. With such information it is possible for the grower to so choose the location for his orchard as to produce distinctive fruit.

The great mass of American apple eaters know but few varieties, and vendors have but little idea of the influence of the location from which a variety comes upon its value. The bulk of the crop sold from the fruit stands is sold on appearance alone. It has been said

that Americans eat with their eyes, and so far as the dessert fruits are concerned this is true. The largest strawberry and the reddest apple, regardless of quality or variety, sell most readily. These peculiarities of the market must not be overlooked by the producer. They are important commercial factors.

The age at which apples come into bearing varies greatly in different parts of the United States. In some of the regions where the industry is rapidly developing the trees come into bearing at from four to six years of age. Under these conditions it is possible for one to realize more quickly upon his investment than in regions where it is necessary to wait eight or even twelve years before the trees yield a crop. It is safe to predict that in those sections where the environmental conditions are such as to force a plant into fruit early the span of life of the plant will be correspondingly shortened. In fact, as a rule those sections which produce such early returns produce only a moderate annual growth of wood, but an abundance of fruit buds considering the size and age of the plants.

Cultivation. The use of modern implements which have been designed for orchard cultivation makes it possible to maintain clean culture under low-headed trees by the use of horse-



An Apple Harvest

power implements alone. A few years ago this would not have been possible. The maintenance of proper cultural conditions is less expensive of human effort nowadays than formerly. The disc harrow, the orchard cultivator, and the light gang plow have combined to increase the efficiency of labor.

While good cultivation is essential, clean culture is not the sole aim. Good cultivation consists not only in stirring the soil to a proper depth at the right time with implements suited for the work, but also in practicing a system of cover cropping which shall maintain the nitrogen and humus supply in the soil so that by the addition of a small amount of mineral fertilizer, in the form of phosphoric acid and potash, a normal plant ration can be maintained in the soil.

In planning the orchard the contour of the land should be considered. If the area is hilly the tree rows should be planned on contour lines with a grade of not more than four inches in one hundred feet. This will allow all cultivation to be done in such a manner as to prevent erosion and with the least expenditure of energy. The slight grade in the rows will permit of drainage without washing, and will permit all cultivation to be performed with the same

expenditure of energy required to cultivate level land. The same arrangement that lightens the burden of cultivation helps at spraying time and at harvest time.

The indicator which may be relied upon to decide whether or not the trees are receiving an adequate supply of food is the *length of the annual* growth. If this growth is six inches or less the tree is on short rations. If it is eight inches or more the tre is well nourished, and if it is twelve inches or more on trees in full bearing the growth is excessive, and the system of cultivation should be modified to suit the requirements of the case. Too little growth is as much to be avoided as too much; both result in crop failure.

In the Eastern United States too little growth may be expected on poor soils long in sod. In the Northwest this condition arises from clean culture and an exhaustion of the limited nitrogen supply. Many of the areas devoted to orcharding in Oregon and Washington are of volcanic origin. The soils have an abundant supply of potash and phosphoric acid, but a limited supply of nitrogen. The trees make a fair growth during their early life and come into bearing early. As fruit production increases the growth of the plant decreases

under a system of clean culture and irrigation with the exhaustion of the nitrogen supply. The remedy in these cases is a leguminous cover crop turned under to take the place of clean cultivation. For the Northwest vetch and the clovers will undoubtedly give best results. In the East vetch, crimson clover, and cow peas are the great nitrogen restorers.

The use of cover crops and other fertilizers should be governed entirely by the growth and fruitfulness of the tree. In some instances the crops must be employed to maintain growth and production. In other cases cultivation and cover cropping must give place to grass in order to check the growth and induce fruitfulness. At this time it is only possible to call attention to these troubles and the means of their control. The success in applying the remedy is the measure of the skill of the orchardist.

Spraying. No single factor of orchard management is of greater importance than spraying. Spraying has done more to place apple culture on a safe basis than any other single discovery of modern times. The use of the spray is to the orchardist what the use of the anesthetic is to the surgeon. It makes it safe and certain. In no department of farm practice has science demonstrated its value to a

greater extent than in the results from spraying. It is within the last thirty years that all we now know and make use of in the control of insects and diseases by the use of sprays has been found out. The spray is almost a panacea for all the ills of the fruit grower.

The proper use of modern insecticides enables the orchardist to protect his trees from scale insects and his fruits from curculio and moth. The fungicides safeguard the leaves of the tree, enabling it to carry on its normal functions, and at the same time protects the fruit itself against rot and scab. The mixtures as well as the methods of applying them are constantly being improved. It would therefore be a waste of effort to record in this place the methods and means considered best for controlling any particular insect or disease. Ask your State Experiment Station or the United States Department of Agriculture, at Washington, D. C., for the latest information, otherwise you may be working at a disadvantage. If one is to insure his crop at all he wishes to do it in the best possible way—to do this keep up with the spray literature.

Harvesting. The relation of the method of harvesting and handling fruit to its keeping qualities have, within recent years, come to be

well understood and are gradually being put into practice. The fact that a perfect fruit keeps better than a bruised or injured one has been so clearly demonstrated in the transportation and storage work conducted by the United States Department of Agriculture that the leaders in fruit growing are beginning to give this care to the handling of apples. So long as the skin of the fruit remains unbroken and the temperature of the storage chamber is below the temperature congenial to the growth of rots and moulds the fruit will keep. Bruised and punctured fruits present openings for the entrance of organisms of decay, and as soon as temperature conditions are favorable rots and moulds appear.

The fact that some fruits hold up well on the market after being removed from cold storage, while other fruit stored under like conditions go down quickly is to be accounted for in the harvesting and handling. It is to be expected that the most carefully handled and the most perfect fruit will hold up longest on the market. The motto of the grower should be *care,*—care in choice of location; care in the choice of varieties; care in planting; care in cultivating; care in harvesting; and care in marketing.

All picking should be done by hand and with great care. If picking sacks are used great care should be exercised in dumping them; if baskets are used they should be lined with cloth to prevent bruising; the fruit should be placed gently in the receptacle, never thrown, and when transferred to the sorting table bruising and rough handling should be avoided.

Packing. During the last decade a great change has taken place in the methods of preparing apples for market. Great care is exercised to produce fruit of high grade, and nowadays great care is taken to grade and pack this high-grade fruit in an attractive manner. A few years ago the fruit was picked from the tree, placed directly in barrels, and sent to the market. Now the fruit is graded and only the best is shipped to market. All injured and undersized fruit is utilized in the manufacture of dried apples, cider, and vinegar. The good fruits are carefully graded and in many localities the choice specimens, which comprise possibly twenty per cent. of the crop, are carefully graded according to size, color, and form and packed into neat boxes holding one bushel.

This box grade has proven worthy of the care bestowed upon it, for in many cases the box

has sold for as much as a full barrel of ungraded stock. These fruits have placed apples in the class with high-grade oranges in the retail trade. Five cents each and three for ten cents is the usual price for them. This grade of fruit should correspond to cream in the dairy business, and like cream the quantity of such fruit will vary from five to twenty per cent of the total crop. A few growers only will produce box apples, as a few dairymen only maintain pure bred herds. The production of this class of fruit is the fine art of fruit growing. The great bulk of the fruit produced will continue to be barrel stock and well it may be so, for the great fruit consuming population can never be supplied with box stock, first, because of the small percentage of fruit suitable for the grade, and second, because the fruit must be supplied at less cost to the consumer.

Barrel stock which will keep as well, cook as well, and taste as well as the box stock can be delivered to the consumer at much less cost. In the first place, barrel stock does not require to be so closely graded as to size and form, while uniformity of size and regularity of form are of the utmost importance in box stock. Color values count for less in barrel stock than in box fruit. In other words expert knowl-

edge is demanded at every point in the production, grading, and packing of box apples. Such knowledge costs more and must be taken account of in the selling price of the product. The production of barrel and box grades of apples may be compared to the manufacture of mowing machines and microscopes. A different quality of workmanship is demanded, the market for one is limited and exacting, for the other general and less critical, but there may be quite as much profit in one line of business as in the other.

The ideal plan is to grade the product, take out the box stock, and grade and pack it in such manner as to secure the highest price for the grade to which it belongs. Then pack a high grade and a second barrel stock and convert everything else into other commercial forms. More profit will follow this practice than will come from eliminating the box grade entirely. The elimination of the box stock tends to make the barrel stock more uniform and therefore more desirable. In the production of all such products, however, there is a point beyond which the work cannot be profitably carried. The careful business man will seek to determine this limit and keep well within it.

Uses. The apple lends itself to a greater variety of profitable uses than any other fruit. While its greatest use is as a dessert fruit, immense quantities are utilized in the manufacture of cider, jellies, and for canning and evaporating.

During recent years methods have been perfected for making cider of extremely high quality and for keeping it in good condition for a long period.*

Since the enactment of the pure food laws and the enforcement of the misbranding clause it is possible to market cider vinegar. Before the enactment of these laws pure fruit vinegars could not be made and sold at a profit and the industry fell into decadence. Now that products are sold for what they really are people are willing to pay a remunerative price for pure cider vinegar, and the utilization of all but the very highest grades of fruit in the manufacture of cider, vinegar, and dried apples has a tendency to relieve the market at harvest time and maintain a better price for barrel and box stock.

Between two and three gallons of vinegar

* See the work of Gore of the U. S. Department of Agriculture.

can be produced from a bushel of apples. With vinegar at fifteen cents per gallon and three gallons per bushel, apples would bring forty-five cents per bushel or $1.35 per barrel for the fruit. This means of disposing of all fruit below the barrel and box grade should be carefully considered. In some localities and under certain conditions it may prove more advantageous to manufacture the lower grades of fruit into jellies and dried stock rather than into cider and vinegar. All these means of disposing of the lower grades of fruit are open to the producer and he should carefully determine which one best suits his conditions.

Marketing. Several methods of disposing of the apple crop have been evolved within the last decade. The crop is to a small extent sold on commission the same as other semi-perishable products, but the commission sales are nowadays a minor factor in the apple business. The American propensity for speculation has, since the perfection of the cold storage system of handling apples, placed this commodity among the regular brokerage stock. While a fraction of the stock placed in storage by the dealers is obtained in the open market, the great bulk of the crop is purchased direct from

the grower, usually at harvest time or before. The crop may be "bought on the trees" at a stipulated price per barrel as they run, or they may be bought at a stated price for each grade. In some instances the owner of the orchard picks the fruit and furnishes the packages, the purchaser doing the packing. In other cases the purchaser picks, packs, and supplies his own packages. All such transactions are the result of private sale.

In a few sections the practice of selling at auction obtains, the fruit being put up and sold to the highest bidder. A modification of this idea has been very successfully used in some localities, the fruit in the orchard being advertised for sale and sealed bids invited to be opened at a given time, the crop to go to the highest bidder. This plan has worked with satisfaction and is better in some respects than the public auction or the private sales plan.

There is one objection to all wholesale systems of selling where the purchaser of the fruit and not the owner of the orchard harvests the crop. There is liable to be more injury to the trees from careless workmen picking on the "piece work plan." Their only object is to harvest as many packages as possible, regardless of consequences. The fruit is apt to be

handled more roughly and its keeping quality as a result somewhat impaired, for it is only carefully handled, perfect fruit which can be expected to keep even in cold storage to the full limit for the variety.

But the most serious factor of all is the loss of the trade standing of the private brand. Every grower should strive to make a reputation in the market for his private mark or brand of fruit. This should be based not only on quality and size but also on style of packing. In some States the grades are determined by law and the private mark of the grower or packer is required upon each package. If this is the case, the auction or wholesale plan of selling works well, provided the grower protects his orchard from careless workmen.

Many extensive growers have adopted the plan of placing their crop in storage either upon the farm or in the market and disposing of it at private sale from time to time as the condition of the market warrants. In the long run this method is undoubtedly most profitable for those so situated as to be able to avail themselves of it.

Still another plan of marketing is through co-operation. The growers instead of doing their own grading and packing deliver their fruit to a central station, where it is graded,

packed, and shipped or placed in cold storage as the judgment of the sales agent and the condition of the fruit and the market may justify. This plan completely obliterates the individual, but has the advantage of maintaining a high grade and uniform pack upon which a reputation for the region can be established. It also has the advantage of wider and more effective distribution, an important matter in these days of immense production. Wide distribution is one of the most effective methods of steadying prices. Congested markets with consequent depression of prices are in this way avoided. The product is sold on order rather than on consignment.

Consignment selling, while it must be depended upon for early apples, is the least satisfactory of all methods. Under present conditions the shipper has no guarantee and no adequate redress. Any man who can rent quarters, publish prices current, and issue rubber stencil stamps may engage in the commission business. The producer stands to meet all charges for production, transportation, and sale, and relies upon the honesty and judgment of the man at the other end to so dispose of the product as to make a profit or loss.

What is needed is a law placing the commission business under as careful protection as that

now required for national banks, together with a constant inspection.

The improvement and protection of the commission sales business is of equal importance to both producer and consumer. Unsatisfactory returns to the producer tend to discourage production, lower the quality, and give the dealer an excuse for charging a high price, which works a hardship upon the consumer and tends to curtail consumption. Liberal production, together with large consumption based on a system of quick sales and reasonable profits to every one, produces most satisfactory economic conditions.

Maintenance of Fertility. The maintenance of fertility in the orchard is as important as it is in connection with any other agricultural crop. Upon some soils fertilizers are essential early in the life of the tree, while upon others they may not be required until the trees are brought under the strain of crop production. The length of the annual growth and the size and color of the fruit should be taken into consideration to determine the kind and amount of fertilizer needed. Short annual growth indicates lack of nitrogen, as does also small, light-colored foliage which drops early in the autumn. Lack of color in the fruit may be due to too much nitrogen in the soil, insufficient sunlight, a result of

bad pruning, or to a lack of potash or iron in the soil. Fertility is not always a determining factor of color in fruit—weather conditions, altitude, and soil all play a part in determining the intensity of the color of a variety.

The maintenance of the fertility in the orchard is accomplished more easily than in the culture of exacting farm crops. In general agriculture the rotation must be so planned as to permit the use of a soil-enriching crop at more or less frequent intervals. In the orchard the trees are perennial and when no other demand is made upon the soil it is a simple problem to maintain an abundant supply of organic matter and nitrogen in the soil by the use of appropriate cover crops. Upon strong soils phosphoric acid and potash only will be required in limited quantities. Of these, phosphoric acid will be required more often than potash. The nitrogen can be secured by the use of crimson clover, vetch, and common clover as a winter cover, and by the use of Canada peas, cow peas, or clover as a summer cover. The mineral elements must be obtained as a commercial manure. Potash in the form of sulphate is as a rule more desirable in fruit growing than muriate, unless for some reason it is desirable to shorten the growing season.

Phosphoric acid can be applied in fine ground

bone meal, floats, or as superphosphate. Usually treated rock phosphate supplies the cheapest source of phosphoric acid. Thomas slag is also a reasonable source for this ingredient. The iron carried in Thomas slag may upon some soils low in iron prove of advantage in coloring the fruit.

The problem of fertilization is a local one. Each orchardist must determine the kind and amount of fertilizer required by his orchard. The soil, the variety, and the method of management will all be found to be factors in the fertility problem. No general formula can be given to cover all cases.

Conclusion. Apple culture under scientific management is a highly remunerative industry. The yield is sometimes as high as fifteen barrels per tree. There may be as many as thirty or forty adult trees to the acre and the price of fruit ranges from one dollar to four dollars per barrel for the fruit. Thirty trees per acre at 1 bbl. per tree at $1.00 per bbl. is qual to $30.00 per acre. Thirty trees at 15 bbls. equals 450 bbls. at $3.00 equals $1,350.00 per acre. These figures represent the range of possibility in apple growing.

CHAPTER VIII

SMALL FRUITS

THE small fruits, like many of the vegetable crops, lend themselves to extensive cultivation as well as to combination and interplanting. The extensive cultivation of special crops such as grapes, raspberries, and strawberries is common in some sections of the United States.

The grape is more extensively cultivated than any other plant of the small fruit group. The climate of Eastern United States for many years discouraged the introduction and cultivation of the grape. It was not until the native vine was found to possess sorts worthy of cultivation that the industry became established. The phylloxera, an insect not known in Europe, but common throughout Eastern America, was the cause of the early failures. But it was many years before this became known; in fact, it was not until the European industry was in danger that the true cause of the difficulty was discovered.

Our present knowledge of the habits and requirements of the European vine has made it possible to establish and maintain an important grape industry upon the Pacific coast, while upon the Atlantic seaboard, where all early attempts to introduce and establish the European sorts proved failures, we have an important commercial grape industry based upon varieties derived from the native wild sorts.

Because of the high development of the art of viticulture grape growing should be recorded among the intensive industries, but unfortunately it is not as remunerative as it was a quarter century ago or as profitable as many other branches of small fruit culture.

The Eastern industry is worthy of special mention because it is based upon a native plant. It has attained a high development and was at one time very remunerative. The chief income from the industry has always been from the sale of dessert grapes, although excellent wines are procured from this fruit. During late years the unfermented grape juice industry has been developed and has proved a valuable asset to the industry.

On the Pacific coast the grape industry is based on the European vine. At first the product was almost exclusively converted into wine

and raisins, but during the last few years more attention has been given to the production of table grapes. This has been possible only since the introduction of the refrigerator transportation service.

The grape industry is an exceedingly highly-developed industry from the standpoint of the art of its culture. No fruit has received more critical scientific study. The difficulties arising from the introduction of the phyloxera into Europe gave a great impetus to the practical application of entomology. It was through the study of the diseases of the vine that Bordeaux Mixture was discovered. This discovery alone has been worth millions to the fruit interests of the world.

The grape industry was the first to enlist the services of trained scientists in solving its cultural problems. A greater share of our present knowledge regarding the control of insect pests and fungus diseases is due to researches called into requisition in connection with the preservation of the viticultural interests of Europe and America.

From a horticultural standpoint no other plant is more interesting than the vine. It lends itself to a great variety of uses, to a wide diversity of soils and climatic conditions. The

methods of pruning and training the vine are extremely variable and form one of the horticultural fine arts. The books on grape culture and training will be found of as great interest as the treatises on espalier training, and the history of the establishment of the grape industry in Eastern United States is horticultural tragedy.

Strawberries and Raspberries. As intensive industries, the cultivation of both strawberries and raspberries are more remunerative than the culture of the vine, although neither is as highly developed. The strawberry is not expensive to establish or to maintain, and when well grown and handled is highly remunerative, and where sufficient labor to handle the crop is available it lends itself to extensive cultivation.

The strawberry is exceedingly cosmopolitan. There are varieties adapted to every portion of the United States and since it gives a quick return is one of the most satisfactory of the small fruits. Yields of six thousand quarts per acre have been produced under favorable conditions, and crops of three to four thousand quarts are not uncommon.

This fruit lends itself to intercropping and to double cropping better than any other fruit

crop. One of the most intensive fruit enterprises in Eastern United States is based on a combination of grapes interplanted with currants and strawberries. Under favorable conditions such combinations return as much as $1,000.00 per acre gross. Such combination plantings require the highest skill on the part of the grower to return satisfactory results. It is easier to grow a single crop on an area than a combination. The return from such intensive enterprises is always a measure of the skill of the grower.

There is no fruit crop that so quickly and lavishly rewards intelligent cultivation and handling. The yield fluctuates between wide margins. The price is also determined by the season, the sort, and the skill of the grower. Grading and attractive packing pay as high a reward with strawberries as with any other fruit crop. Strawberries are sold largely upon size and color. The selection of sorts possessing both size and color is of the utmost importance in the success of this industry.

Black and red raspberries are both crops capable of producing highly satisfactory returns. In localities where fruit is scarce and where the red raspberry thrives well, as in portions of Wisconsin and Minnesota, the crop is

highly profitable. It is also a valuable addition to the small fruit plantation for a local trade. As a rule it is not profitable to ship this fruit more than a very few miles. When prepared for market it should never be handled in larger than pint receptacles. Quart boxes are too large for so soft a fruit. The red raspberry comes into bearing early and when well cared for on strong soil stands many years, thus making it a most satisfactory plant both for market and for the home fruit garden. The chief expense in handling the crop is the cost of picking.

Black raspberries, on the other hand, are not restricted to use as a dessert fruit as is the red berry. Black caps are grown extensively in some localities for drying. The invention of a mechanical means of harvesting the crop, together with the use of the modern evaporator, has made it possible to grow this crop on an extensive scale. Some growers in western New York have as many as eighty acres devoted to the industry. The return ranges from $50 to $200 per acre.

This crop fits well into a fruit enterprise involving strawberries, black raspberries for evaporation, peaches, and apples. Fortunately nature has provided a number of sections in

northeastern United States where this combination of fruits can be successfully produced. As a rule it is not wise to plant these crops in combination. It is more satisfactory to handle them separately if land area is available and is not too expensive. The crops can be interplanted and successfully and profitably handled, but the average grower will succeed best by planting each sort on a separate area and treating it as a distinct crop. These crops follow one another in successions so as to provide almost continuous employment the season through.

CHAPTER IX

THE CITRUS INDUSTRY

THE citrus industry of the United States, which is chiefly made up of the cultivation of oranges, lemons, and pomelos (grapefruit), is one of the most highly organized agricultural industries of the world. Geographically this industry is confined to the southern and southwestern portions of the United States, in fact to those portions of our country possessing a subtropical climate. The two regions so far developed may for convenience be spoken of as the Florida and the California areas. In point of age the Florida region is older, but measured by the commercial output the California industry is much greater.

While the citrus industry is highly organized, it is also a specialized industry, and being a specialized industry it is necessarily an intensive industry. The gross return per unit of area covered by oranges or lemons is equaled by but few crops. The lands occupied are expensive. The fixed charges in the form of irriga-

LEMON HARVESTING SCENE

tion, cultivation, and marketing are large items of expense. The trees are planted close, come into bearing at an early age, and soon pay expenses when carefully handled, turning a profit at from five to six years from planting. A good grove in full bearing is not only a most beautiful sight, but it is highly profitable unless, perchance, it is overcapitalized or poorly managed. With these crops, as with all others, overcapitalization, bad location and management all lead to the same destination. But under the best of management there are apt to be, from time to time, severe losses from cold. In fact, severe freezes have been the cause of the greatest disasters known in this industry. The first great insurance to the success of the industry is a frost free location. The second is a suitable variety, and the third good marketing facilities.

Location. With all highly sensitive fruits the question of suitable location is a most important one. Much can be done to remedy a bad bargain in location by the use of smudges, smokes, and heaters, and while these means of protection should be borne in mind as emergency measures they should not be a fixed annual maintenance charge, but should, on the contrary, be found among the insurance items.

In other words, do not locate where the annual use of fire pots is necessary for the protection of the crop. The use of such devices should be the exception and not the rule. All other factors, such as soil, rainfall or irrigation facilities, distance to the railroad, and packing house, should be carefully studied, as should also the labor problem.

Variety. No fruit plant is more profoundly influenced by its environment than the orange. Varieties are exceedingly exacting regarding their location. Some that do not thrive or bear well in the Florida section are the most valuable commercial sorts in the California area. But varietal preferences are not the only factors in this environment problem. Sorts that thrive well in both Florida and California show marked contrasts in the two sections. One of the most striking differences of this nature is to be noted in the thickness of the rind of the same sort in Florida and California. There is, however, a marked difference between varieties, and each locality possesses sorts of special value well suited to its conditions.

Marketing. No industry has ever responded in such a magic manner to " scientific methods " as has the citrus industry. The work of the California Fruit Growers' Exchange has solved

the problem of distribution and marketing and the United States Government has solved the problem of harvesting and transportation. Both problems are handled in a highly efficient and scientific manner.

The growers acting as a unit through the Fruit Growers' Exchange were able to standardize their product by uniform methods in grading and packing. The individual with a few boxes of fruit, were it not for the citrus selling organizations, would not be able to dispose of his product except to local jobbers, who would oftentimes be compelled to regrade and repack the fruit. The association packing house plan does away with all this and makes it possible for those with less than carload lots to pool their interests with others and secure the benefits of standard grades and packs as well as shipment in carload lots. Organization could accomplish this unaided, but it could not stop the loss from decay in transit, and it was at this point that scientific management under the direction of a trained horticulturist entered the field, determined the causes leading to the losses in transit, and by applying simple and easy methods practically eliminated them. An interesting feature of this achievement was that the processes of handling were simplified

and cheapened at the same time that the losses from rot were overcome. The outcome of the matter is that the orchard and packing house practices have been improved, with the result that these operations now cost less than formerly; the losses in transit have been eliminated, and the net profits to the industry increased by the sum total of these savings.

An additional safeguard is being investigated. It is the idea of promptly and rapidly cooling the fruit to the temperature to be maintained in the refrigerator car before it starts on its long journey across the continent, instead of as formerly depending upon the ice in the car to serve to supply refrigeration both to reduce the initial temperature of the fruit and to keep it cool regardless of the outside temperature through which the car must pass in its journey to a distant market.

Precooling, as this process is called, takes the fruit from the packing house and quickly reduces the temperature to a point at which the ripening processes and the activities of the rots and moulds, which are the chief causes of loss in stored fruit as well as fruit in transit, are arrested. The plan of shipping under ice does not demand fruit to be at this low temperature when loaded, but takes the fruit direct from the

packing house and depends upon time in transit and re-icing to reduce the fruit and maintain it at a safe temperature. The heavy losses sustained under this plan, amounting in some cases to thirty per cent., attest the inadequacy of the system. The insulation and refrigeration of the car should be required to do only one act—maintain a safe temperature—and not be required to develop as well as maintain that temperature.

Normal ice temperatures are not rigorous enough to rapidly drive the heat out of a carload of fruit so that a safe temperature can be developed before injury has actually taken place from moulds and rots. The mass of the load and the size of the unit packages impose too great a burden upon the ice and insulation of the car to secure satisfactory results. The car, when well built and fully iced, will carry a precooled load safely across the continent, but it cannot receive a hot load, cool it, and safely transport it. Precooling is the factor which guarantees the work of the refrigerator car in the handling of highly perishable products. It is such safeguards that place industries in the intensive class.

Lemon Curing. The art of curing lemons was for many years attended by heavy losses

and a product of widely varying quality. Through careful studies of the field handling of the crop the causes of decay were located and can be almost entirely eliminated through careful methods of handling. The variable product of the curing house is no longer necessary. The conditions essential for the proper curing of the lemon have been determined and by carefully heeding these principles a uniform, high-grade product can be turned out, provided good stock is furnished in the beginning. The results which have been secured to these industries by scientific investigation are among the most striking economic achievements of recent years. The losses which were sustained by these industries before the investigations were undertaken removed almost completely the possibility of a profit. The reduction of the losses has insured profits proportionately.

CHAPTER X

PLANT BREEDING AS A FACTOR IN INTENSIVE AGRICULTURE

INTENSIVE agriculture is not the production of special crops, the cultivation of which is intensive. It is the development of a system of farming in which the various factors are so adjusted as to make a highly organized and at the same time specialized aggregate or unit. Nevertheless, plant breeding may play an important part in the efficiency of the aggregate. The correct adjustment of satisfactory units may not result in the desired end because of the inefficiency of the units. To make an effective aggregate the units themselves must be of a high character.

A dairy farm may fail because the individuals in the herd are not efficient. The cropping system may be well suited to the soil and climate and to the need of the dairy herd. The housing of both stock and provender may be of a desirable character and the marketing of the product may be well handled, but with un-

profitable animals the whole enterprise is defeated. The remedy in this case is found in the readjustment of one factor—the stock. This can be accomplished gradually by building up the herd or by the sale of the undesirable individuals and the purchase of satisfactory ones.

If the aggregate is based on a cash return from some vegetable crop, such as potatoes, the profits can usually be greatly increased by a proper rotation and good cultivation, but frequently most of all by attention to the selection and development of highly productive and desirable types. A little hill selection work will suffice to convince one of the value of improved stock. A casual inspection of the product of a series of hills of potatoes carefully dug so as to keep the product of each hill separate will at once bring out the fact that in some hills there are only two or three tubers, in others one large and three or four small tubers, in others three or four large and three or four small tubers, and still others four or five large and but few small tubers.

If all types of hills are present in about equal numbers the yield of the field is a mean between the high and low yielding hills. If the low yielding hills are more abundant their pres-

ence is indicated in the yield. If, on the other hand, there are seventy or eighty per cent. of the hills producing a high yield, the return from the area will be correspondingly increased. Tests have demonstrated that a strain of potatoes can be built up and maintained, seventy to eighty per cent. of which will be made up of productive hills, with the result that the yield is correspondingly increased.

By proper selection it will be possible under good cultivation to double the usual yield of any ordinary strain of potatoes in two or three years, and this without materially increasing the cost of production. There is probably no extensively tilled crop that responds so readily to the hand of the cultivator as the potato.

In order to bring about such improvement it is necessary to plant the seed in such a way as to get an indication of the character of the product each tuber will produce. Start by cutting each tuber into four pieces, cutting from end to end so as to split the terminal bud. Plant the four pieces one after another in separate but adjacent hills. There will then be four hills from one tuber; four hills from another, and so on down the row. At harvest time the product of the four hills from any given tuber can be thrown together, and an

inspection of the piles as to number, size, and conformation of the tubers will quickly determine those best suited for further observation. From each of the piles considered desirable for further test select ten tubers and plant them so as to make forty hills each the following season, taking care not to mix the tubers from the various piles. The harvest of the forty hills from each lot will again indicate those best suited for continuance.

The one lot of forty hills showing the greatest yield of tubers of the desired type should be made the basis of the next season's seed patch, and should be planted on one side of the field so as to be harvested separately the following autumn. By following this plan from year to year, the shape, size, number of tubers to the hill, and the aggregate yield can be profoundly and profitably modified. The efficiency of the aggregate in which such high-efficiency strains enter cannot but be more satisfactory and profitable than those in which low-grade strains are used. All plants increased from seed or from vegetative parts can be made more profitable and more desirable by such simple methods. Many of the uncertainties can be overcome by care in handling the seed.

With annual crops such as cabbage, lettuce,

onions, etc., the seed supply is well purchased one year in advance so that it may be tested in a small way the year before it is planted for crop returns. If it is not true to type one at least has the satisfaction of knowing it before the whole crop comes on. The best plan is, however, to grow one's own seed whenever possible from carefully selected stock plants. In that way plant breeding can be made to contribute in a very practical way to intensive farming.

The insurance provided by special devices, such as hotbeds, cold frames, greenhouses, and irrigation, avails the grower little unless the plants he grows are especially adapted to the purpose for which they are intended.

Plants for special purposes have not up to the present time been developed to a high degree of perfection. It is only among the market gardeners and florists that plants for special purposes are found.

Gardeners have varieties of lettuce, cucumbers, and tomatoes which have been developed to meet the peculiar needs of the artificial environment of the greenhouse and the trade which supports the industry. These crops do not thrive well in the open, but are par excellence for greenhouse conditions. The Grand Rapids forcing lettuce is a notable example of

a greenhouse product which has been developed for a special purpose and which is not well suited for outdoor conditions.

The most noteworthy examples of special purpose varieties are to be found among the cucumbers, melons, and tomatoes which have been developed by English and European gardeners. The great length of the English forcing cucumbers, the superior texture and flavor of the forcing melons and the fruitfulness and mildness of flavor of the forcing tomatoes are striking characteristics. As a further proof of their distinctive characters none of these sorts are as valuable when grown in the open as the ordinary field sorts.

High Protein Corn. The work of Dr. Hopkins at the Illinois Experiment Station clearly demonstrates the possibility of developing cereals with distinctive qualities. The protein content of corn has been decidedly increased and correlations have been established which make it possible to determine by observation the kernels which possess more than the normal protein content.

The development of high sugar content in the sugar beet is a striking instance of the ability of breeders to develop and establish special qualities in plants. The beet normally contains

about twelve per cent. of sugar, but the best strains of commercial beets contain as high as fifteen to twenty per cent. of sugar, with a high percentage purity.

These illustrations are only a few of the many that might be mentioned, such as the various forms of garden peas; the great difference between the climbing and bush types of lima beans; the various forms of cabbage, cauliflower, and brussels sprouts, all of which have been produced from a common parent.

The examples first mentioned are most interesting because the results have been brought about by efforts of men well known to present day workers. The great mass of the forms that have been preserved and are now included in the trade lists have appeared as sports or mutations, and have been preserved because of their distinctive characters.

During recent years many florists have devoted a portion of their thoughts and effort to the improvement of the plants with which they were working, and as a result many new and valuable varieties have been brought out. For a number of years Mr. Arthur Cowie has given special attention to the development and establishment of new forms of gladiolus. The results of his work are not measured

merely by the number of varieties he has produced, but they have been of such excellence as to make the work highly remunerative.

Mr. Ward's efforts in the breeding of carnations have furnished the trade with a number of very excellent sorts which when introduced by the originator returned a handsome compensation.

A single illustration will suffice to substantiate this point. In the issue of the *American Florist* for January 27th, 1906, the following item is recorded:

"C. W. Ward, of the Cottage Gardens, Queens, N. Y., sold Carnation Rachel Marie Thompson to the J. D. Thompson Carnation Company, Joliet, Ill., January 15, for $10,000, this sum to be paid when the purchaser has realized same on sales. It will be remembered that this variety, which is in the light pink class, scaled 90 points at the Chicago show last fall and was awarded the sweepstakes prize. It won the same prize at the Kansas City show."

Beside developing sorts Mr. Ward has made a record of the work which he did in a real contribution to the literature of the carnation.

The introduction and popularization of the American Beauty rose was financially profitable to Mr. Henry K. Field, and the Richmond, although a comparatively new sort, has not only made a lasting name for Mr. E. G. Hill, its

originator and introducer but has netted him a handsome profit.

Not all plant breeders have, however, received the pecuniary reward their achievements deserve. Peter Gideon, whose name will always be associated with the real progress of Northwestern fruit growing, never received commensurate reward for his work, and the same may be said of Mr. T. V. Munson, who has done more for Southwestern grape growing than any other American. Mr. Munson carried on very extensive breeding work for many years, and thanks to his foresight and energy his results are preserved to posterity in the varieties he has developed and in the record of how they were produced. Fortunately for horticultural science, Mr. Munson was a gentleman of wealth who has made plant breeding his pleasure for many years.

It would be interesting to sketch the work and results of all who have made lasting contributions to horticulture, but the list is too long to be considered in this chapter. A few such names as the Downings, Prince, Bull, Bartram, Forsyth, Henderson, Barry, Livingston, Bailey, Tracy, and others are too well known to require special mention. There are a host of equally deserving workers whose names will

never be known, but their work gives both pleasure and profit to others as well as to themselves.

The pecuniary reward is not the only return from effort expended in plant breeding. The pleasure that comes from successful accomplishment in this field is in direct proportion to one's love of plants. Plant breeding carries enough of the element of chance to place it almost within the list of questionable occupations or diversions. Once one becomes interested it is as intoxicating as a game of chance, but for those who learn the laws and rules of the game the play becomes a scientific achievement.

Among the master minds that started the thoughts that evolved into the theories out of which our modern science of plant breeding has developed were Chas. Darwin, Herbert Spencer, Alfred Russel Wallace, and Thos. Andrew Knight in England, and Mendel, Van Mons, Nileson, Tschermak, and the Vilmorins on the continent, and Sturtevant, Cape, Saunders, Bailey, and others in America. No single mind gave a complete solution for the problem, but all have made contributions of inestimable value.

CHAPTER XI

SEED GROWING

THE growing of special crop seeds offers illustrations of some of the most intensive types of special crop development. The seeds of some flowers and vegetables are very valuable. The skill required in their production is difficult to acquire and is possessed by but few. But those who possess the skill to produce these products receive handsome remuneration for the product when measured in terms of weight or land area, although the return is not always so satisfactory when measured in terms of *man hours.*

Flower Seed. An interesting instance of the apparent large return from highly specialized industries is afforded by the work of an expert grower of petunia seed. This grower through his independent effort worked out the laws of Mendelian inheritance without knowing it and successfully applied them in the commercial production of petunia seed. He produces the finest double petunia seed grown in the world. The methods he employs are based on a knowledge

of the behavior of the first generation hybrid combined with carefully worked out laws of inheritance. By taking advantage of the constancy of the first generation hybrid to perpetuate certain form and color characters which have been determined to be dominant, this gentleman is able to produce seed superior to that grown by anyone else.

This success in scientific breeding is equally a success from a financial standpoint, for this petunia seed sells readily at $100 per ounce, the highest priced commercial seed in the world. An ounce of seed can be produced on 1-100 of an acre, or at the rate of $10,000 per acre. This, like many other industries, looks good on paper and is in reality a good and profitable industry. The "fly in the ointment" is due to the fact that a great amount of the most careful and painstaking effort is required in this work and as the season is limited and man's abilities are restricted, a few ounces (6 to 10) measure the possibilities of the individual in any given season. But even if the seed cannot be grown by the acre and the product measured in tons, what other industry would in a few months return from one-tenth of an acre so large a return? Other flower seeds are profitably grown, but none produce such returns.

Vegetable Seed Growing. At the present time vegetable seeds are usually grown on the contract system, the stock seed being supplied by the contractor under number at a given price, the product to be paid for at an agreed figure. Under this system varieties have become general mixtures and the trade has in a measure lost its character. There is little inducement for improvement and little hope for high grade seed under this system. The plan produces good seed when judged on the basis of viability, but high-grade seed should be distinctive and true to type.

A few growers are making a specialty of selecting and breeding high-grade seed. These growers demand and are able to secure an extra price for their produce. When the work is carefully and conscientiously done the grower can well afford to pay from fifty to two hundred per cent. more for select seed. The advantages are higher viability, which means a better stand; trueness to type, which means a more uniform product and more even maturity, factors of the greatest economic importance in commercial garden operations. The men who are carrying on such work are so few that their output makes little impression on the trade. The writer knows of but two

men handling cabbage seed in this way, one who grows asparagus roots from carefully selected seed, a half dozen who grow selected onion seed, one who is selecting beets, and a few greenhouse growers who select their own lettuce and cucumber seed.

The seed industry is the basis of all successful market gardening and truck farming. Thousands of dollars are expended in the erection of greenhouses and forcing plants and in the equipment of farms and gardens for growing vegetables *from seed the grower knows nothing about.* It is strange that people will risk equipment, labor, and skill in attempting to produce high-grade products from *nondescript seed.* Yet this is the general practice among truck farmers.

The success attained by such men as W. W. Rawson with special cucumber seed, by Mr. Hittinger with the Belmont Forcing lettuce, by Mr. Davis with the Grand Rapids Forcing lettuce, and of the Senior Livingston in the breeding of tomatoes, should be a sufficient guarantee to justify persons with a love for such work devoting their time and energies to it. To succeed one must understand the peculiarities of the crop. Have a suitable location, soil, and climate and know the market demands, and if

in addition, a thorough working knowledge of the science of plant breeding is possessed, success will be more certain and earlier.

What has been accomplished with corn and cotton can be attained with the vegetable crops. In fact, the problem is half solved with the vegetables. There is an abundance of forms. What is needed is intelligent selection of parent stock and persistent line breeding to establish and maintain high-grade strains of seed. New sorts are not needed. Seed true to name, with good growing power, will solve the problem. That these results can be attained is amply proved by the success of the United States Department of Agriculture in its efforts to eliminate the green sport from Grand Rapids lettuce, and in establishing a superior strain of early cauliflower, and incidentally in demonstrating the commercial possibility of growing cauliflower seed in Eastern United States.

CHAPTER XII

THE NURSERY AN EXAMPLE OF INTENSIVE CROP PRODUCTION

THE nursery business like the seed business has become commercialized. It is now carried on on a large scale by competent business managers and has very largely been reduced to a process of plant manufacturing. Because fruit and ornamental plants lend themselves to rapid multiplication on an extensive scale the intensive industry now recognized has been made possible.

Peach pits planted in the autumn will have by the following July produced plants large enough to bud with the desired sorts. The work of budding can be done rapidly and still secure a large percentage of successes. This makes it possible to produce plants true to variety in immense numbers. Hundreds of thousands are annually grown by some of the large nursery firms. These small plants do not demand a great deal of space. They are usually planted in rows three and one-half to four feet

apart, and the young plants six to eight inches apart in the row. The buds set in July and August do not start in to growth until the following spring, but as soon as the top of the original seedling is cut away the dormant bud pushes rapidly into growth, and by the end of the season, on good soil and with good cultivation, a marketable tree worth from twenty to one hundred dollars per thousand has been produced.

At the distances mentioned it is possible to grow 22,300 plants per acre. Plums can be produced in the same way and in the same length of time. Nowadays apples are handled in much the same way, but instead of the seedlings being grown in place they are grown by others in a different section. The year old seedlings are purchased by the nurserymen and either used for root grafting or are lined out in nursery rows four feet apart with the plants eight to ten inches apart in the row. Yearling plants lined out this way in April or May will have formed growth to permit budding them in July and August. The buds set in the autumn will during the next year produce a large majority of trees suitable for the market. Soil, climate, culture, and the variety all influence the size and character of the product.

Root grafting produces trees for the trade in the same length of time, but as a rule the budded tree will be largest. This is undoubtedly due to the fact that the entire root is used when the seedlings are lined out for budding, but only a fraction of the root is used for piece root grafting. This is not the place for a discussion of the relative merits of the two systems of propagation. The point is that in two years from the time the seedling is placed in the nursery row a merchantable tree can be produced either by budding or by root grafting. The return per acre varies with the variety and the method followed in disposing of the stock.

Nowadays there is less difference between the wholesale and retail price of nursery stock than formerly. The greatest difference is found between purchases made through agents and those made direct from the nurseryman. It is more economical for the planter to purchase direct from the grower whenever practicable.

While mention has only been made of peaches, plums, and apples, the whole list of nursery products is handled on the same intensive scale.

Strawberries are propagated by runners sometimes by the hundred acres, millions of

Peaches by the Car Load

plants being produced. A large number of plants can be grown on an acre, and at the usual wholesale price of $2.50 to $5.00 per thousand plants, a very satisfactory business can be built up. Like all other special industries, it requires skill and good business ability.

CHAPTER XIII

IRRIGATION

IRRIGATION may be of two kinds,—irrigation to supplement normal precipitation in humid regions; or irrigation to provide moisture for crop production in arid regions.

Irrigation when used as a supplement to normal precipitation is considered as a form of crop insurance, and is employed only with crops producing a large net return per acre. This method of using water and its economic effects are discussed in connection with the subject of crop insurance as well as under the special crops requiring irrigation in humid sections.*

No single factor in agricultural practice offers greater advantages than a controllable water supply. Water under control can be applied as the soil and the plant require it and in such quantity as the species demands. The advantages of such a controlled water supply need no demonstration or argument.

* See also "Garden Farming."

Accurate knowledge of the methods of applying water, as well as the requirements of the various agricultural crops, are prime essentials to the successful use of a controllable water supply. These factors vary with the soil, the contour of the land, the season of the year, and the crop. For these reasons each irrigated district should be provided with an experiment station where these important local factors may be determined.

Irrigation entails high fixed charges. Land with a water right is necessarily expensive. The original cost of canals, laterals, and tile drainage are all items entering into the ultimate cost of irrigable lands. An annual rental or charge based on land or water units must be paid for the maintenance of canals and laterals where the system is a co-operative enterprise among the farmers benefited. When the water is provided by a private corporation the charge for water must not only pay the costs of maintenance but must provide a dividend on the capital invested.

The cost of providing water varies from a few dollars per acre, for the man who can divert water from a perennial stream upon his own land, to as much as $35 to $70 per acre where larger canals are required. The annual

water rental varies from fifty cents to $2.50 per acre.

Irrigated lands are valued at from $100 to $1,500 per acre, depending upon their location and the crops for which they are adapted.

Economics of Irrigated Land.—Land valued at $150 per acre with an annual water charge of $1.50, has an annual fixed charge of interest and taxes on $150 plus a pro rata amount of the general improvement of the place, plus $1.50 water rent. An example of what this change may be is afforded by the following:

40 acres of raw land at $150.00	$6,000.00
House	1,000.00
Barn	400.00
Other buildings	300.00
Fencing	200.00
Cistern or well	125.00
Total	$8,025.00

To which must be added cost of tools, teams, and other equipment, together with an annual charge for depreciation on all equipment of at least ten per cent., and some classes should be charged a much higher rate even than this.

Teams, tools, and equipment		800.00
		8,825.00
Depreciation on $800.00	$ 80.00	
Interest on $8,825.00 at .08=	706.00	
Water rent at $1.50	60.00	
Annual fixed charge	$846.00	
Annual fixed charge per acre	21.15	

Crop Rotations on Irrigable Lands.—The crop rotation which can be practiced on any given area will depend upon latitude and climate of the area, and the size and accessibility of markets.

Latitude and Climate.—The latitude and climate of a region determines to a greater or less degree the crop possibilities of that region. A northern latitude and a high altitude mean short seasons and a limited crop list.

Southern latitudes and sea level mean, as a rule, long seasons and correspondingly long and valuable lists of products.

To illustrate, take the possible crop list of irrigated areas between 100 and 110 meridians and north of the 38 parallel. The crop list is confined to wheat, oats, barley, corn (in part), alfalfa, millet, sorghum, potatoes, sugar beets, cabbage, peas, turnips, beans. Among fruits, apples in certain portions, strawberries and small fruit.

Take a farm where grain farming only can be followed.

40 acres, one acre for house lot.						
9	acres	in	sugar beets,	15 tons at	$5.00	$ 675.00
10	"	"	potatoes,	150 bu. at	.35	525.00
10	"	"	oats,	70 bu. at	.30	210.00
10	"	"	alfalfa,	30 tons at	5.00	150.00
Total gross income						$1,560.00
" " "					per acre	39.00

As has been noted, the fixed charges against

such a farm amount to $21.15 per acre. $39 less $21.15=$17.85 gross profit, from which must be deducted cost of hired help and a wage for the owner if he works the place.

Allow $240 for hired help and there would exist a net profit of $11.85 per acre on the year's operations. It is evident from this calculation that a more remunerative cropping system must be devised in order to make irrigation pay. The question is can this be done under the environment? An analysis of this case shows that alfalfa at $15 per acre gross gives a loss of $6.15 per acre plus the cost of production. Either the crop must be abandoned or a more profitable method of disposing of it devised. It is likely that if the alfalfa were fed to dairy cows it would return a larger income than by direct sale. If it can be made to return the equivalent of the annual fixed charge per acre it will be wise to retain it in the rotation, for it prepares the land for profitable crops of both potatoes and sugar beets.

The cropping system mentioned is about as profitable as any that can be devised for this environment. In order, therefore, to make a place of this size produce a day wage for the owner it will be necessary to change the plan of utilization so as to sell the alfalfa more ad-

vantageously. If dairy cows can be handled so as to make the alfalfa profitable a secondary profit will at once appear in the pigs and calves that can be grown on the skim milk.

In the event that dairying proves to be the solution of the problem the herd should be adjusted to the working force of the family so as not to create an added labor charge. In contrast with this let us make an inventory of a forty-acre tract located farther south and near the sea level.

The cropping system and return from a forty-acre place under irrigation in a more favorable location:

Value of land $200 per acre, interest 8%, charge	$16.00
Value of improvements $50 per acre, interest 8%, charge	4.00
Water charge	1.50
Taxes	1.00
Total annual charge per acre	$22.50
Rotation:	
8 acres alfalfa (4 tons at $6), $24	$ 192.00
8 " oats, 800 bu. at 30c	240.00
8 " potatoes, 2,400 bu. at 30c	720.00
8 " alfalfa	192.00
8 " beets (15 tons at $6), $90	720.00
	40) $2,064.00
Total gross per acre	51.60
Total fixed charge per acre	22.50

Total margin of profit from which cost of pro-

duction must be deducted	29.10
Total margin on 40 acres	1,164.00
Labor hired	600.00
Total net profit or labor income	$ 564.00

In some other locality where economic conditions were different land bearing the same overhead charges might be made to pay a handsome profit. If the gross return from potatoes were fifty cents per bushel and the gross return for beets were $5.50 per ton, and alfalfa produced a gross return of $45.00 per acre, then a four-year rotation such as has been described, would bear the fixed charges and pay a profit.

A 40-acre orange grove, with paid-up water right, at $500 per acre		$20,000.00
Three years' maintenance at $50 per acre, plus $15 per acre annual water charge		7,800.00
		$27,800.00
Interest on $27,800 for 3 years at 8%		6,672.00
		$34,472.00
INCOME FROM CROP		
3rd year—1 box per tree (80 per acre at $1)	$ 3,200.00	
Less cost of production	4,000.00	
Profit	—800.00	
Interest on $34,472 at 8%	2,757.76	
Net cost		3,557.76
Total cost to end of 3rd year		$38,030.00
4th year—Estimated value of crop	$ 7,000.00	
Cost of production	4,000.00	
Income	3,000.00	

Interest on $38,030.....	3,043.00	
Net return		—43.00
Total cost at end of 4th year....		$38,073.00
5th year—Estimated value of crop...	$15,000.00	
Cost of production.....	6,000.00	
Income	9,000.00	
Interest on $38,073.....	3,046.00	
Net return		5,954.00
Total cost at end of 5th year....		$32,119.00
6th year—Estimated value of crop...	$16,000.00	
Cost of production.....	6,000.00	
Income	10,000.00	
Interest on $32,119.....	2,570.00	
Net return		7,430.00
Total cost at end of 6th year....		$24,689.00
7th year—Estimated value of crop...	$18,000.00	
Cost of production.....	6,000.00	
Income	12,000.00	
Interest on $24,689.....	1,975.00	
Net return		10,025.00
Total cost at end of 7th year....		$14,664.00
8th year—Estimated value of crop...	$20,000.00	
Cost of production.....	6,000.00	
Income	14,000.00	
Interest on $14,664.....	1,173.00	
Net return		12,827.00
Total cost at end of 8th year....		$ 1,837.00

9th year—Estimated value of crop	$20,000.00	
Cost of production	6,500.00	
Income	13,500.00	
Interest on $1,837	147.00	
Net return		13,353.00
Total net income in 9 years		$11,516.00
To which must be added present worth of the 40-acre grove at $1,000 per acre		40,000.00
Total value at end of 9th year		51,516.00
Less original investment		20,000.00
Net gain		$31,516.00

In this case the minimum gross return is estimated at $80 and the maximum at $500 per acre. Such incomes amply justify the large expenditures for improvement and maintenance. Crops that return an income of less than $70 to $100 per acre gross cannot be made to pay interest and produce a revenue on many irrigated areas.

Such crops as celery, onions, cabbage, potatoes, sugar beets, or some of the seed crops which return a large profit per unit are the only ones that can be profitably handled under irrigation outside the fruits, such as oranges, lemons, apples, pears, stone fruits, and strawberries.

Every system of agriculture should be studied in detail in some such manner as we have

analyzed these types of irrigation farming before their advantages or defects can be detected. In fact, an analysis of this character is the only method by which the non-productive factors in a rotation can be detected. By determining the "pay streaks" and improving them and at the same time finding out the "dead heads" and eliminating them so far as practicable is the only sane method of improving the economic condition of the farm unit. It is a question of following and improving the pay and of stopping the leaks. The more expensive the plant and the more intensive the industry the greater the importance and significance of such an analysis.

CHAPTER XIV

ANIMAL INDUSTRY

ANIMAL industry has in the past been considered among the extensive rather than the intensive industries. It is quite true that the grazing of cattle on a thousand hills is extensive agriculture, but animal industry is not confined to cattle and sheep grazing. It includes the breeding of thoroughbred stock of various sorts, and the rearing and fattening of animals for special purposes, such as hothouse lambs and pigs for special brands of sausage and bacon. These industries are highly intensive and require great knowledge, care, and skill on the part of the manager.

Breeding of Thoroughbred Animals.—No branch of agriculture requires greater skill, keener judgment, and more constant attention for success than animal-breeding. No line of agricultural work, however, affords greater satisfaction or better rewards than successful breeding. The original investment in animals of high individual merit from the leading fami-

lies of their class is large. The risk involved is therefore great, and although great care has been exercised to mate animals of superior merit for many generations in all the well-established breeds, it does not follow that every individual will prove to be a potent stock getter. Animals with great prepotency are highly prized. They give character to the family and often guarantee ready sale at high prices for all offspring of their get. The male is usually the dominant factor both in breeding cattle and horses, but the female transmits through her male offspring such superior qualities as great butter or milk production, or in the case of horses great track performance. It is, therefore, of the greatest importance that both sides of the house be noted for the same line of performance.

While these records are important and are likely to give the desired result, they are not a guarantee. Experience proves that certain animals from the same litter will possess marked value as breeding individuals, while an own brother from the same litter will be almost worthless. There are many records of this sort among dogs and pigs. The development of special purpose breeds of animals has come about entirely as a result of the skill of the breeders. The peculiar markings of the breeds

have become almost constant. The general conformation of the animal; the ability to lay on fat at an early age; to produce a large quantity of butter fat are all marked characters of certain breeds and strains. In sheep certain breeds have been developed for mutton, others for wool of various grades, and still others for large increase as in the case of the Horned Dorset, which nearly always produces twins and frequently breeds twice a year.

While it is possible to develop highly specialized breeds, it is not possible to unite in a single breed the highest development of opposing attributes. To illustrate, beef production and milk production are opposite attributes. The breeds or strains highly developed for milk or butter production are not the best for beef production and *vice versa.* The draught and race horses represent highly developed breeds with contrasting characters. From what has been stated an idea of the intricate character of the problems of animal-breeding can be formed. The evolution of breeds of animals like the development of nations has its history. To succeed in the work one must be familiar with this history, know the royal strains of blood, and be able to recognize the marks of superiority in the young animal.

The history of the Short Horn cattle is most interesting and illustrates the possibilities of animal-breeding as well as the great value of individual animals. The sale at New York State Mills demonstrated the worth of individuals of certain families.

The record of any of the leading breeds of hogs, sheep, or poultry will afford equally striking examples of high prices for superior individuals. No line of animal breeding has had such an extraordinary history as the breeding of Silver Foxes. There have been fads and crazes in almost every department of agricultural activity, but none more remarkable than that of the fox industry. For a number of years a few individuals have successfully reared these valuable animals in captivity. They have demonstrated that the Silver Fox, famous both in literature and trade, is a pure strain, breed, or species, and not a sport, as has popularly been supposed.

The demonstration of this fact, together with the great value of the pelts and the successful rearing of the animals in captivity has made breeding stock sell for almost fabulous prices. Pelts sometimes sell for $1,000 to $1,500 each. The great value of the individual, coupled with the fact that the young are

born in litters, has stimulated the greatest rivalry among purchasers, so that as high as $15,000 has been paid for a single pair. So far as is known this marks the high tide of speculative animal-breeding.

High prices have frequently been paid for superior individuals with a marked performance record. Horses, cattle, sheep, hogs, and poultry all have records of notable sales, but these were based on performance records in the ring or on the track. The fox business progressed by leaps and bounds, prices were doubled in a few months, and the end is not yet. Some of the results counted as successes in animal-breeding have been determined by fashion. Fashion is a merciless mistress. It builds fortunes out of fads and wrecks deserving industries. What fate awaits "Domeno" in his new role fashion alone will determine, but the fact that the Silver Fox is a pure strain and can be successfully bred in captivity is an important contribution to the breeding literature of the world.

CHAPTER XV

ECONOMICS OF INTENSIVE INDUSTRIES

THE intensive industries we have so far discussed make up the major part of the intensive agriculture of America. Intensive agriculture is more than intensive agricultural industries. It is a complex consisting of a number of agricultural industries so articulated that the whole is a harmonious profitable unit. In America the tendency during late years has been toward intensive industries instead of toward the intensive complex. The development of the single-crop system leads to the most risky type of agriculture. Special or single-crop systems tend to deplete fertility, to fatigue the land, to develop malnutrition troubles, and to stimulate the ravages of both insect enemies and fungus diseases.

Where intensive crops are grown as single crops, not as a part of a complex rotation, it is often expensive and difficult to maintain fertility, but where the special crop is articulated with a rotation system which carries a legumi-

nous crop to provide the nitrogen a balanced ration can easily be provided by the purchase of the two elements, phosphoric acid and potash.

The complex which most closely approaches the ideal is one in which there is a minimum of waste and the maximum of profit. The soil should be continuously occupied by a growing crop planted for profit or for soil improvement. A maximum number of high profit-yielding crops should be included in the rotation without depleting the fertility of the land. The labor supply should be ample, but no more than can be continuously and profitably used. The ideal complex will be so planned as to use practically the same amount of labor the year round. On such a basis labor can be more advantageously purchased. A constant uniform labor supply is more efficient and less costly than a fluctuating supply. The by-products from one crop should contribute to the support of another factor in the complex.

A well-planned and well-executed system of diversified agriculture should constitute the most intensive system of agriculture, though not perhaps the most profitable. As a rule, we think the most intensive agriculture should be the most profitable, but this does not necessarily

follow. There are few types of agriculture which utilize land, labor, or products more completely than the dairy industry and none which maintains fertility more perfectly, yet the net returns when measured by cash receipts are small.

On the other hand, a highly developed market garden may utilize the land and labor just as thoroughly but within itself produce no means of keeping up soil fertility, and yet return a handsome net profit. The defect in such a system is that it is dependent upon outside sources for one of its important factors, viz., manure to maintain the fertility of the soil. Fortunately, however, the city which uses the products of the garden has an ample supply of fertilizer to return to it.

Special crops usually require the purchase of commercial fertilizers or manures in order to maintain fertility. In some cases highly profitable special crops, such as oranges, lemons, or other tree fruits which occupy the land for a period of years may be so handled as to provide the nitrogen requirements of the crop by means of the growth of legumes, which when turned under also add to the humus content of the soil. Such a system of management will reduce the cost of maintenance and increase the production

of the plantation. As a rule, the use of manure or green crops turned under is more economical than the use of commercial fertilizers.

The continued use of large quantities of high-grade commercial fertilizers sooner or later brings about soil conditions manifestly uncongenial to the plants as indicated by their appearance. In humid regions this is as a rule easily corrected by the use of stable manure in large quantities or by plowing under leguminous crops, such as crimson clover or cow peas. The presence of liberal quantities of decomposing organic matter in the soil appears to be essential to correct adverse conditions brought about by the excessive use of fertilizers. Dangers of this sort are not liable to develop in a complex based on the sale of high-grade finished products such as cattle, horses, or dairy products.

The truck farm, as usually maintained, is above all others the one most liable to develop uncongenial soil conditions. The excessive application of commercial fertilizers without an adequate use of either stable or green manure is responsible for these troubles. Now that the cause of the difficulty as well as its remedy is well understood it becomes an easy matter for the truck farmer to protect himself against such misfortunes by the use of stable manure or by

using a rotation in which green crops are turned under.

Truck farming, like all other highly specialized industries, has been carried on in the way most "single crop" systems of farming are conducted. The industry is not based on a single crop, but in general the results are much the same though from altogether a different cause.

Single-crop farming, except when based on some special perennial crop, is usually a pioneer type of agriculture and consists merely in garnering the natural fertility of the soil by the continuous use of a single crop. No heed is given to the future. The plan is to get the greatest possible return in the shortest time, regardless of consequences. The same idea has actuated the truck farmer, but his crops were not sufficiently abundant, without the use of fertilizers, to be profitable. Maximum yields were desired, and as heavy dressings of fertilizers produced large yields, heavy applications of fertilizers were, therefore, the logical and necessary accompaniment of large yields. But there came a time when the soil reached its limit. The plant used such elements as it needed and left the others. The excess or residual part of the fertilizer left in

the soil after a number of years of intensive cropping with the use of heavy applications of fertilizers brought about a condition uncongenial to the plant and actual toxic results followed. Plants suffering from the results of such practices are abnormal in color, development, and give unprofitable returns.

CHAPTER XVI

THE CROPPING SYSTEM AS A UNIT

THE average agricultural enterprise of the Middle West—based on grain and live stock farming—produces a net profit to the operator of 4.5 per cent.; any increase over this amount may be considered an approach toward intensive agriculture. This estimate is based on the results of more than ten years of careful statistics on individual farms. While the rate is not high, it is higher than the rates of interest paid on savings accounts and is probably as high as the average net income of any other extensive industry.

This is quite different from the rate of profit from special crops or special types of agriculture. It is the net income from all the activities of the average farm. There are a great variety of special agricultural industries which produce much higher results. In fact, in some parts of the country tenant farming, when well managed, as is shown in southeastern Mary-

land,* pays the landlord a higher rate of income than that shown by this average farm. It must be remembered also that in order that there may be an average farm there are those which return more and still others that return a net of even less than 4.5 per cent.

In agriculture as in all other lines of endeavor the *personal equation* of the operator plays a most important part. The influence of this personal factor is manifest more clearly in agriculture than in any other calling, for the reason that the skill and judgment of the farmer appear in his crops, in the environment of his home, and in his live stock. Most other industries and trades are less exposed and are more restricted. The farmer, on the other hand, manifests his abilities in much the same manner as an artist, but his canvas is his farm and his materials are his crops. The picture is always on exhibition. It sometimes happens that what makes up a pleasing and apparently well conceived study may not prove a satisfactory one financially. Sometimes the farmer who is apparently the best and most prosperous farmer of a community is not making money and he is not able to determine the cause of his failure. Such is a case for careful investiga-

* Farmers' Bulletin No. 437, U. S. Department of Agriculture.

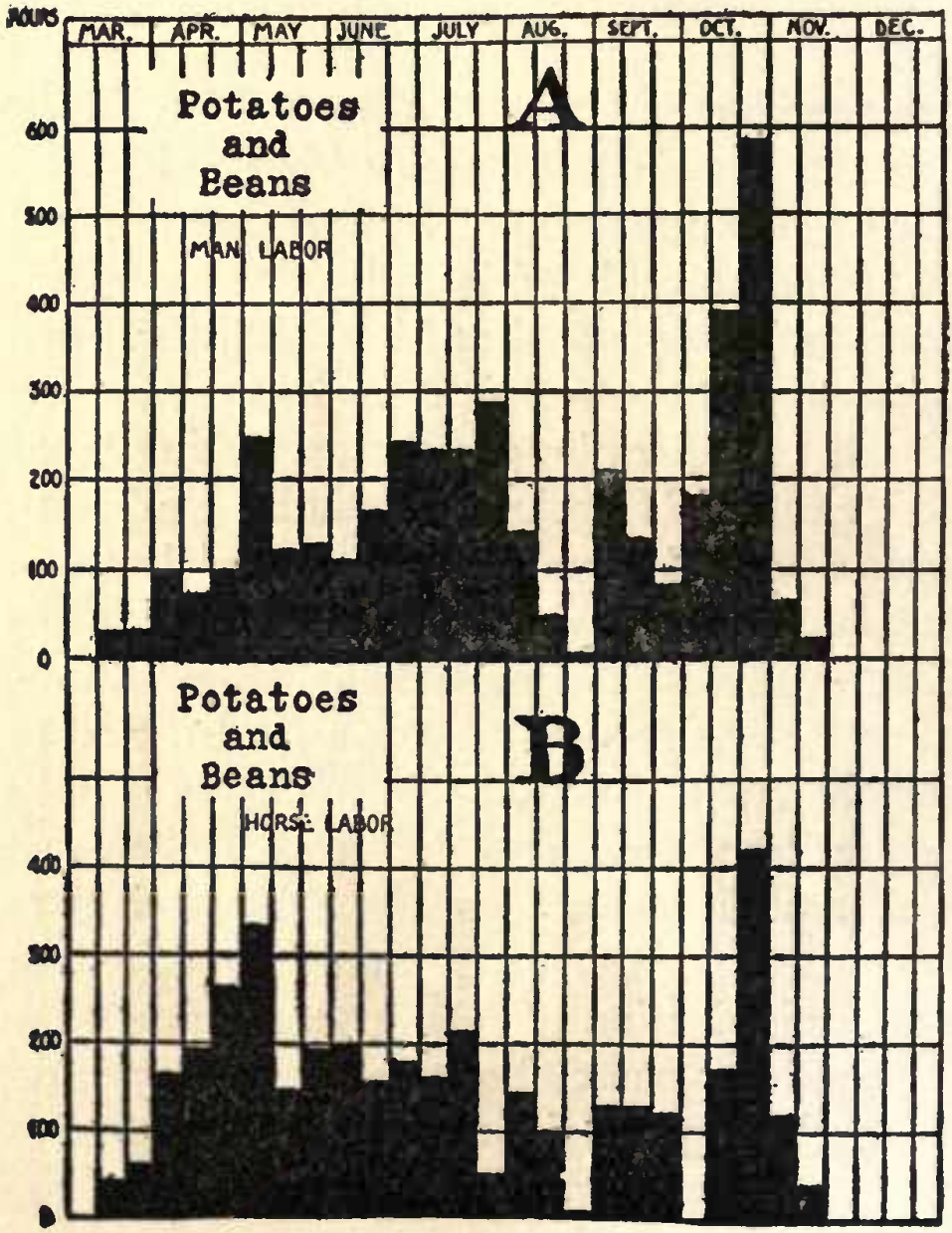
tion. Each factor in the complex must be painstakingly considered and the whole system on which the operation of the farm rests must be studied to determine where it is out of harmony.

Sometimes the crop rotation is well suited to the soil and the system of farming, but the manner of feeding is faulty, or the stock itself may be unsuited to the purpose for which it is maintained. The part played by each factor must be carefully considered in order that an operation may be conducted at high efficiency.

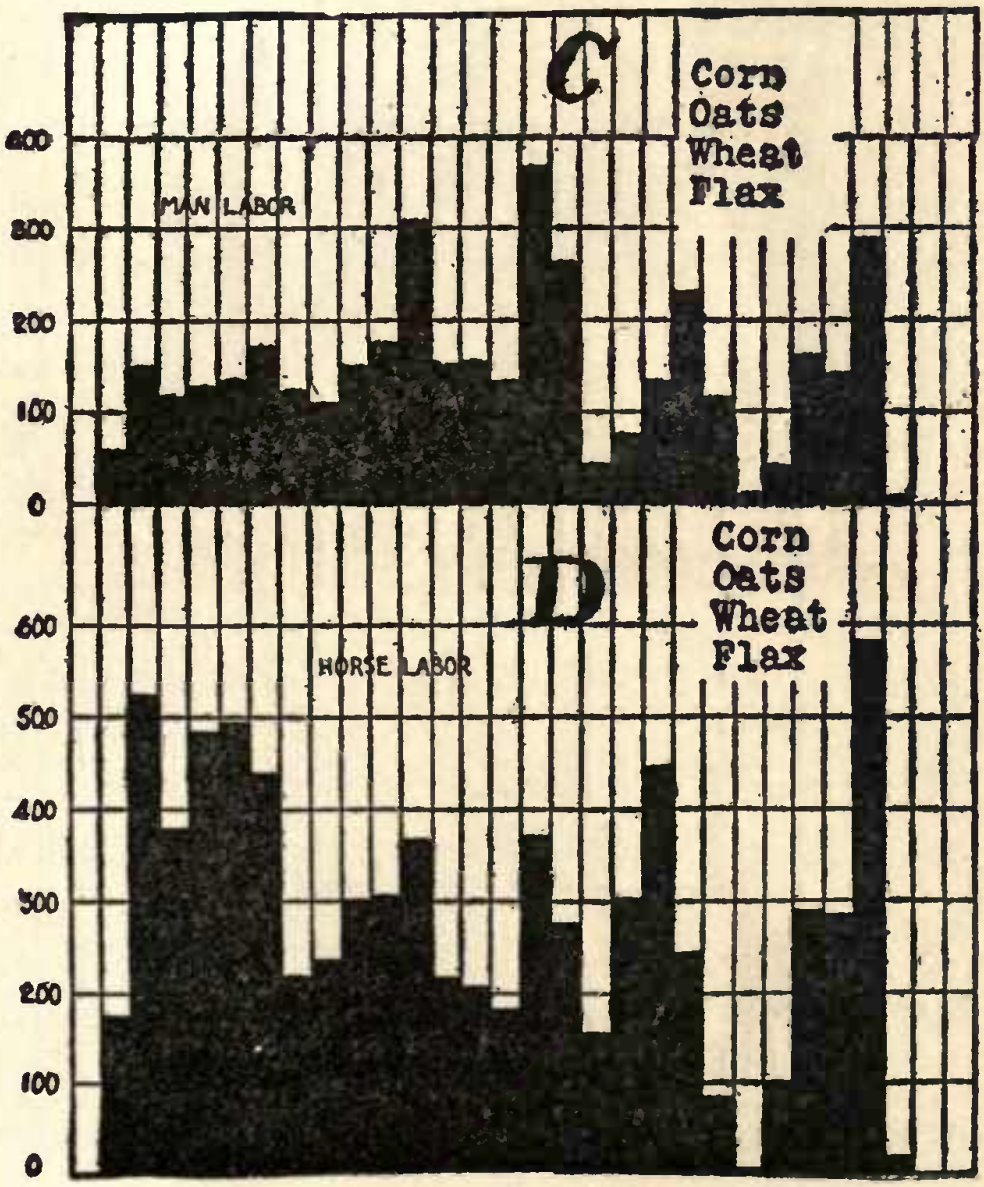
One of the most serious handicaps to most agricultural operations is the fluctuating labor requirement. If agriculture could be adjusted so as to profitably employ a constant labor supply throughout the year there would be far less difficulty in maintaining a farm labor supply, but so long as farm labor is engaged for seven or eight months instead of for twelve months there will be farm labor problems. The great number of unemployed in the cities is cited as an economic evil, but in commenting upon the uneven distribution of immigrants between the farm and city one authority says, "They know too much to go to the country." If the labor supply is the great agricultural problem of the age, as it is conceded to be, it is evident that

it cannot be remedied without a radical readjustment of farm practice which will create a continuous demand for labor at a remunerative wage.

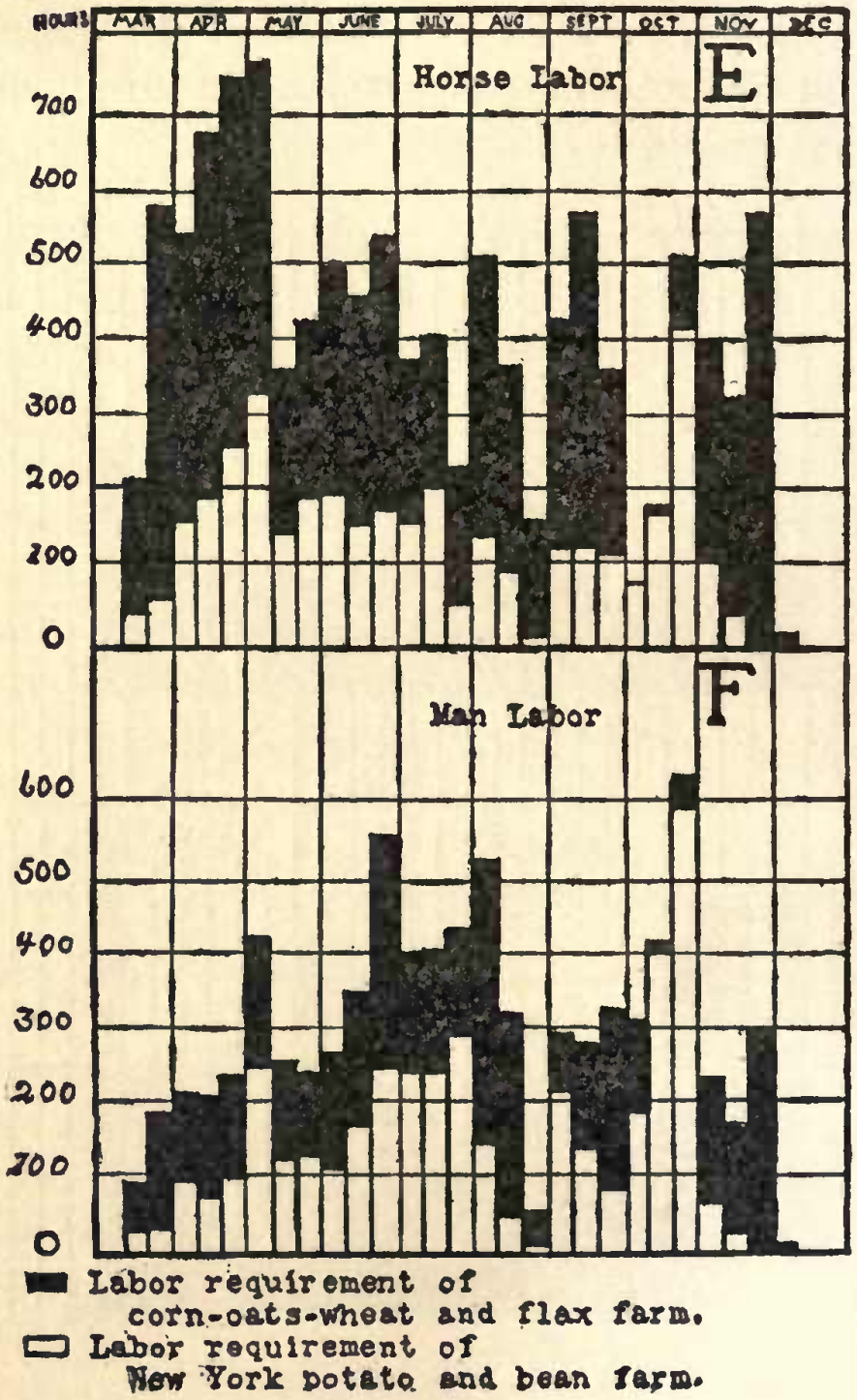
Improved machinery has gone a long way in



smoothing out the inequalities in the labor requirements by making the man and the horse more efficient. The future advance seems to lie along the line of the adaptation of the motor tractor to the requirements of agriculture, and as the demand for increased production grows,



and it will ever grow with higher-priced land, agricultural efficiency in every line must be more carefully considered.



The accompanying charts represent the horse and man labor required on two farms. Chart A shows the amount and the distribution of man labor in the production of potatoes and beans in the climate of New York. Chart B shows the horse power required and the periods in which greatest demand is made upon this same farm in the production of potatoes and beans. Chart C represents the man labor required on a farm in which the rotation consists of corn, oats, wheat, and flax. This represents the actual hours of labor and shows the highpoints in the system. Chart D, when compared with C, indicates the relation between man and horse labor on such a farm and points out the periods when horse power is in greatest demand.

These charts clearly bring out the fact that the maximum horse and man labor required upon each of these farms is greatly in excess of the average requirement for the crop. To illustrate: During the periods of harvesting potatoes and beans there is a great excess of both man and horse labor required over any other period during the growing season. This period of stress in the potato and bean fields is luckily not a period of stress with corn, oats, wheat, or flax, so that if the demands for man and horse labor during planting season for corn, oats,

wheat, and flax does not overlap the period when excessive man and horse labor is required by potatoes and beans these crops might be satisfactorily worked into a rotation.

Chart E represents the horse power required by the combined potato-bean and corn-oats-wheat-flax rotations. While there are appreciable variations in the combined requirements of these rotations, the fluctuation is not greater than in either alone. In fact, they correspond pretty closely to the variations shown in the bean-potato rotation alone.

Chart F shows a combination of the man labor required on the potato and bean farm and the man labor required on the farm producing corn, oats, wheat, and flax. While the maximum requirement is slightly raised above the maximum requirement for potatoes and beans, this increase is very slight, and at other points in the chart the maximum is very much more nearly approached by a combination of these rotations than by growing either of them separately.

The point is that if it were possible to have labor charts for each of the standard crops grown in any crop zone it would be possible to take into consideration, in making up a crop rotation, not only the returns from the crop in

forage and grain, the benefit to be derived from the maintenance of soil fertility, but also the economic features of crop production bearing upon the labor supply. The labor problem on the farm involves the economical distribution of labor and as such becomes a vital factor in the crop rotation. Crop rotations assume a new aspect when labor distribution is added to crop returns and the maintenance of production. The ideal farm system is one which permits the economic use of a constant labor supply and until such a system is worked out the labor problem of the farm will continue to exist.

The Distribution Problem. So far factors of crop production have been the only ones considered. It is, however fully realized that problems of distribution are of equal rank with those of production and our immediate advances, it is believed, lie in this direction. Economies in field practices and increased yields through the use of fertilizers cannot be made effective against increased transportation and distribution charges. Freight rates may not actually be increased or commission charges changed to effect a very important result in net return with a declining market or an increasing cost of production. To illustrate: The rates charged for transport-

ing table grapes from western New York points to the large cities of the East are the same to-day that they were in 1880. The ratio which transportation bore to the net return in 1880 was 5 per cent. In 1900 this ratio had changed so that the rate of transportation which had not been changed represented over 40 per cent. of the net return. This state of affairs has come about through a change in price for the commodity.

Freight rates are assessed on the basis of tonnage or a mileage charge and are usually expressed in terms of ton mile. This arbitrary basis may furnish a simple and satisfactory basis of computation for the railroads, but it takes no account of value, or time required in transit. Farm products vary greatly in transportation requirements. The staple commodities, such as hay, grains, sugar beets, etc., can be handled on a slow schedule, but perishable products and live stock must be transported with the greatest dispatch and on fast schedules. It is obvious that time is an important element in this problem, but up to the present our transportation agencies have not given due regard to it. In some of the European countries the time factor is given due weight in fixing charges.

Picking the Golden Globes in California

The distribution problem involves not only the rate and price of transportation but the area covered by the distribution. One of the greatest drawbacks to our present system of marketing is the lack of direct distribution. Nearly all farm products offered for sale go from the farm direct to a *few* large cities, the smaller cities and towns depending upon a redistribution from these large centers. This involves delay, deterioration, an added transportation charge, rehandling, and added commissions, sometimes also terminal or refrigeration charges, or both. Is it any wonder that perishable goods are stale before they reach the consumer or that prices are high?

Better distribution must be considered as a factor in intensive agriculture. Intensity in farming should mean effectiveness, and effectiveness in transportation is secured only through directness. The small city which can buy its perishable supplies direct from the producers instead of from another city market will in general save in time, save in freight, save in expense, and save in quality of the goods. Is it worth while? It is, if the dealings of a single community stand for anything.

By direct, honest dealing this community, through its own selling agencies, disposed of

two million dollars' worth of its own products at its own shipping point, so that the prices received saved to the community the cost of transporting the crops to the city market, a saving of fully $150,000. The purchaser paid no more for the goods or for freight than would have been paid had he bought them *second hand* in the city. Second hand goods are usually a little stale. By direct purchase the dealer in the small city actually saved on first cost, paid no more freight, secured fresher goods, and by so doing gave his customers a better product.

THE END

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INDEX

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2. CAMP COOKERY, by Horace Kephart. "The less a man carries in his pack the more he must carry in his head," says Mr. Kephart. This book tells what a man should carry in both pack and head. Every step is traced—the selection of provisions and utensils, with the kind and quantity of each, the preparation of game, the building of fires, the cooking of every conceivable kind of food that the camp outfit or woods, fields or streams may provide—even to the making of desserts. Every recipe is the result of hard practice and long experience.

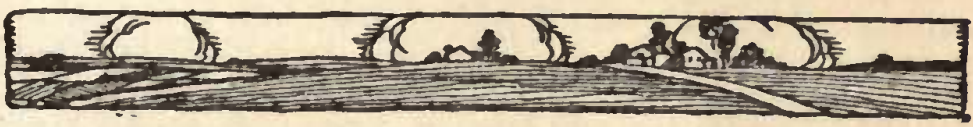
3. BACKWOODS SURGERY AND MEDICINE, by Charles S. Moody, M. D. A handy book for the prudent lover of the woods who doesn't expect to be ill but believes in being on the safe side. Common-sense methods for the treatment of the ordinary wounds and accidents are described—setting a broken limb, reducing a dislocation, caring for burns, cuts, etc. Practical remedies for camp diseases are recommended, as well as the ordinary indications of the most probable ailments. Includes a list of the necessary medical and surgical supplies.

4. APPLE GROWING, by M. C. Burritt. The various problems confronting the apple grower, from the preparation of the soil and the planting of the trees to the marketing of the fruit, are discussed in detail by the author. Chapter headings are:—The Outlook for the Growing of Apples—Planning for the Orchard—Planting and Growing the Orchard—Pruning the Trees—Cultivation and Cover Cropping—Manuring and Fertilizing—Insects and Diseases Affecting the Apple—The Principles and Practice of Spraying—Harvesting and Storing—Markets and Marketing—Some Hints on Renovating Old Orchards—The Cost of Growing Apples.

5. THE AIREDALE, by Williams Haynes. The book opens with a short chapter on the origin and development of the Airedale, as a distinctive breed. The author then takes up the problems of type as bearing on the selection of the dog, breeding, training and use. The book is designed for the non-professional dog fancier, who wishes common sense advice which does not involve elaborate preparations or expenditure. Chapters are included on the care of the dog in the kennel and simple remedies for ordinary diseases.

6. THE AUTOMOBILE—Its Selection, Care and Use, by Robert Sloss. This is a plain, practical discussion of the things that every man needs to know if he is to buy the right car and get the most out of it. The various details of operation and care are given in simple, intelligent terms. From it the car owner can easily learn the mechanism of his motor and the art of locating motor trouble, as well as how to use his car for the greatest pleasure. A chapter is included on building garages.

7. FISHING KITS AND EQUIPMENT, by Samuel G. Camp. A complete guide to the angler buying a new outfit. Every detail of the fishing kit of the freshwater angler is described, from rodtip to creel, and clothing. Special emphasis is laid on outfitting for fly fishing, but full instruction is also given to the man who wants to catch pickerel, pike, muskellunge, lake-trout, bass and other freshwater game fishes. Prices are quoted for all articles recommended and the approved method of selecting and testing the various rods, lines, leaders, etc., is described.



8. THE FINE ART OF FISHING, by Samuel G. Camp. Combine the pleasure of catching fish with the gratification of following the sport in the most approved manner. The suggestions offered are helpful to beginner and expert anglers. The range of fish and fishing conditions covered is wide and includes such subjects as "Casting Fine and Far Off," "Strip-Casting for Bass," "Fishing for Mountain Trout" and "Autumn Fishing for Lake Trout." The book is pervaded with a spirit of love for the streamside and the out-doors generally which the genuine angler will appreciate. A companion book to "Fishing Kits and Equipment." The advice on outfitting so capably given in that book is supplemented in this later work by equally valuable information on how to use the equipment.

9. THE HORSE—Its Breeding, Care and Use, by David Buffum. Mr. Buffum takes up the common, every-day problems of the ordinary horse-users, such as feeding, shoeing, simple home remedies, breaking and the cure for various equine vices. An important chapter is that tracing the influx of Arabian blood into the English and American horses and its value and limitations. Chapters are included on draft-horses, carriage horses, and the development of the two-minute trotter. It is distinctly a sensible book for the sensible man who wishes to know how he can improve his horses and his horsemanship at the same time.

10. THE MOTOR BOAT—Its Selection, Care and Use, by H. W. Slauson. The intending purchaser is advised as to the type of motor boat best suited to his particular needs and how to keep it in running condition after purchased. The chapter headings are: Kinds and Uses of Motor Boats—When the Motor Balks—Speeding of the Motor Boat—Getting More Power from a New Motor—How to Install a Marine Power Plant—Accessories—Covers, Canopies and Tops—Camping and Cruising—The Boathouse.

11. OUTDOOR SIGNALLING, by Elbert Wells. Mr. Wells has perfected a method of signalling by means of wig-wag, light, smoke, or whistle which is as simple as it is effective. The fundamental principle can be learned in ten minutes and its application is far easier than that of any other code now in use. It permits also the use of cipher and can be adapted to almost any imaginable conditions of weather, light, or topography.

12. TRACKS AND TRACKING, by Josef Brunner. After twenty years of patient study and practical experience, Mr. Brunner can, from his intimate knowledge, speak with authority on this subject. "Tracks and Tracking" shows how to follow intelligently even the most intricate animal or bird tracks. It teaches how to interpret tracks of wild game and decipher the many tell-tale signs of the chase that would otherwise pass unnoticed. It proves how it is possible to tell from the footprints the name, sex, speed, direction, whether and how wounded, and many other things about wild animals and birds. All material has been gathered first hand; the drawings and half-tones from photographs form an important part of the work.

13. WING AND TRAP-SHOOTING, by Charles Askins. Contains a full discussion of the various methods, such as snap-shooting, swing and half-swing, discusses the flight of birds with reference to the gunner's problem of lead and range and makes special application of the various points to the different birds commonly shot in this country. A chapter is included on trap shooting and the book closes with a forceful and common-sense presentation of the etiquette of the field.

14. PROFITABLE BREEDS OF POULTRY, by Arthur S. Wheeler. Mr. Wheeler discusses from personal experience the best-known general purpose breeds. Advice is given from the standpoint of the man who desires results in eggs and stock rather than in specimens for exhibition. In addition to a careful analysis of stock—good and bad—and some conclusions regarding housing and management, the author writes in detail regarding Plymouth Rocks, Wyandottes, Orpingtons, Rhode Island Reds, Mediterraneans and the Cornish.

15. RIFLES AND RIFLE SHOOTING, by Charles Askins. A practical manual describing various makes and mechanisms, in addition to discussing in detail the range and limitations in the use of the rifle. Treats on the every style and make of rifle as well as their use. Every type of rifle is discussed so that the book is complete in every detail.

16. SPORTING FIREARMS, by Horace Kephart. This book is the result of painstaking tests and experiments. Practically nothing is taken for granted. Part I deals with the rifle, and Part II with the shotgun. The man seeking guidance in the selection and use of small firearms, as well as the advanced student of the subject, will receive an unusual amount of assistance from this work. The chapter headings are: Rifles and Ammunition—The Flight of Bullets—Killing Power—Rifle Mechanism and Materials—Rifle Sights—Triggers and Stocks—Care of Rifle—Shot Patterns and Penetration—Gauges and Weights—Mechanism and Build of Shotguns.

17. THE YACHTSMAN'S HANDBOOK, by Herbert L. Stone. The author and compiler of this work is the editor of "Yachting." He treats in simple language of the many problems confronting the amateur sailor and motor boatman. Handling ground tackle, handling lines, taking soundings, the use of the lead line, care and use of sails, yachting etiquette, are all given careful attention. Some light is thrown upon the operation of the gasoline motor, and suggestions are made for the avoidance of engine troubles.

18. SCOTTISH AND IRISH TERRIERS, by Williams Haynes. This is a companion book to "The Airedale," and deals with the history and development of both breeds. For the owner of the dog, valuable information is given as to the use of the terriers, their treatment in health, their treatment when sick, the principles of dog breeding, and dog shows and rules.

19. NAVIGATION FOR THE AMATEUR, by Capt. E. T. Morton. A short treatise on the simpler methods of finding position at sea by the observation of the sun's altitude and the use of the sextant and chronometer. It is arranged especially for yachtsmen and amateurs who wish to know the simpler formulae for the necessary navigation involved in taking a boat anywhere off shore. Illustrated with drawings. Chapter headings: Fundamental Terms—Time—The Sumner Line—The Day's Work, Equal Altitude, and Ex-Meridian Sights—Hints on Taking Observations.

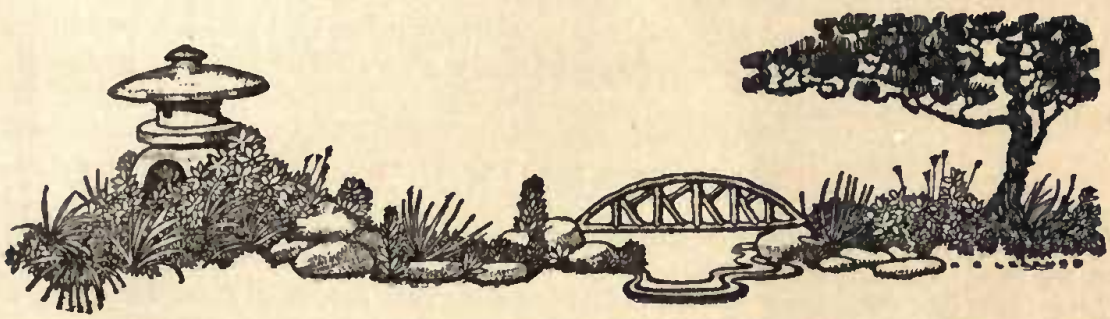
20. OUTDOOR PHOTOGRAPHY, by Julian A. Dimock. A solution of all the problems in camera work out-of-doors. The various subjects dealt with are: The Camera—Lens and Plates—Light and Exposure—Development—Prints and Printing—Composition—Landscapes—Figure Work—Speed Photography—The Leaping Tarpon—Sea Pictures—In the Good Old Winter Time—Wild Life.

21. PACKING AND PORTAGING, by Dillon Wallace. Mr. Wallace has brought together in one volume all the valuable information on the different ways of making and carrying the different kinds of packs. The ground covered ranges from man-packing to horse-packing, from the use of the tump line to throwing the diamond hitch.

22. THE BULL TERRIER, by Williams Haynes. This is a companion book to "The Airedale" and "Scottish and Irish Terriers" by the same author. Its greatest usefulness is as a guide to the dog owner who wishes to be his own kennel manager. A full account of the development of the breed is given with a description of best types and standards. Recommendations for the care of the dog in health or sickness are included. The chapter heads cover such matters as:—The Bull Terrier's History—Training the Bull Terrier—The Terrier in Health—Kenneling—Diseases.

23. THE FOX TERRIER, by Williams Haynes. As in his other books on the terrier, Mr. Haynes takes up the origin and history of the breed, its types and standards, and the more exclusive representatives down to the present time. Training the Fox Terrier—His Care and Kenneling in Sickness and Health—and the Various Uses to Which He Can Be Put—are among the phases handled.

24. SUBURBAN GARDENS, by Grace Tabor. Illustrated with diagrams. The author regards the house and grounds as a complete unit and shows how the best results may be obtained by carrying the reader in detail through the various phases of designing the garden, with the levels and contours necessary, laying out the walks and paths, planning and placing the arbors, summer houses, seats, etc., and selecting and placing trees, shrubs, vines and flowers. Ideal plans for plots of various sizes are appended, as well as suggestions for correcting mistakes that have been made through "starting wrong."



25. FISHING WITH FLOATING FLIES, by Samuel G. Camp. This is an art that is comparatively new in this country although English anglers have used the dry fly for generations. Mr. Camp has given the matter special study and is one of the few American anglers who really understands the matter from the selection of the outfit to the landing of the fish. His book takes up the process in that order, namely—How to Outfit for Dry Fly Fishing—How, Where, and When to Cast—The Selection and Use of Floating Flies—Dry Fly Fishing for Brook, Brown and Rainbow Trout—Hooking, Playing and Landing—Practical Hints on Dry Fly Fishing.

26. THE GASOLINE MOTOR, by Harold Whiting Slauson. Deals with the practical problems of motor operation. The standpoint is that of the man who wishes to know how and why gasoline generates power and something about the various types. Describes in detail the different parts of motors and the faults to which they are liable. Also gives full directions as to repair and upkeep. Various chapters deal with Types of Motors—Valves—Bearings—Ignition—Carburetors—Lubrication—Fuel—Two Cycle Motors.

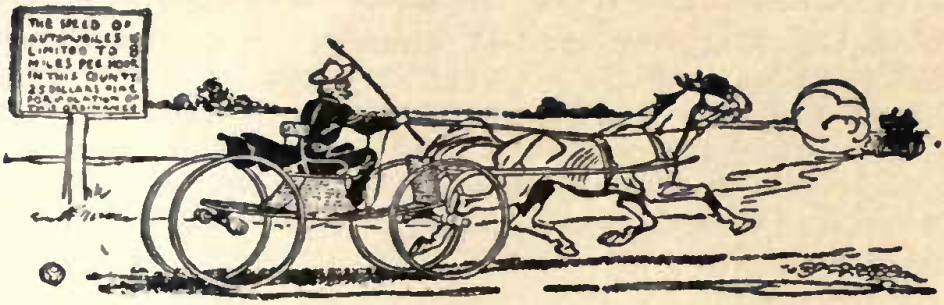
27. ICE BOATING, by H. L Stone. Illustrated with diagrams. Here have been brought together all the available information on the organization and history of ice-boating, the building of the various types of ice yachts, from the small 15 footer to the 600-foot racer, together with detailed plans and specifications. Full information is also given to meet the needs of those who wish to be able to build and sail their own boats but are handicapped by the lack of proper knowledge as to just the points described in this volume.

28. MODERN GOLF, by Harold H. Hilton. Mr. Hilton is the only man who has ever held the amateur championship of Great Britain and the United States in the same year. In addition to this, he has, for years, been recognized as one of the most intelligent, steady players of the game in England. This book is a product of his advanced thought and experience and gives the reader sound advice, not so much on the mere swinging of the clubs as in the actual playing of the game, with all the factors that enter into it. He discusses the use of wooden clubs, the choice of clubs, the art of approaching, tournament play as a distinct thing in itself, and kindred subjects.

29. INTENSIVE FARMING, by L. C. Corbett. A discussion of the meaning, method and value of intensive methods in agriculture. This book is designed for the convenience of practical farmers who find themselves under the necessity of making a living out of high-priced land.

30. PRACTICAL DOG BREEDING, by Williams Haynes. This is a companion volume to PRACTICAL DOG KEEPING, described below. It goes at length into the fundamental questions of breeding, such as selection of types on both sides, the perpetuation of desirable, and the elimination of undesirable, qualities, the value of prepotency in building up a desired breed, etc. The arguments are illustrated with instances of what has been accomplished, both good and bad, in the case of well-known breeds.

31. PRACTICAL DOG KEEPING, by Williams Haynes. Mr. Haynes is well known to the readers of the OUTING HANDBOOKS as the author of books on the terriers. His new book is somewhat more ambitious in that it carries him into the general field of selection of breeds, the buying and selling of dogs, the care of dogs in kennels, handling in bench shows and field trials, and at considerable length into such subjects as food and feeding, exercise and grooming, disease, etc.



32. PRACTICAL TREE PLANTING, by C. R. Pettis. The author, who is the New York State Forester, takes up the general subject of reforesting, covering nature's method and the practical methods of broadcast seed-sowing, seed spot planting, nursery practice, etc. The various species are described and their adaptability to varying conditions indicated. Results of reforesting are shown and instructions are given for the planting of windbreaks and shade trees.

33. GUNSMITHING FOR THE AMATEUR, by Edward C. Crossman. Mr. Crossman, who is one of the best-known rifle experts in the country, takes up in detail the care and repair of the gun. He discusses such questions as The Present Development of the Gun—Tools for the Amateur—Rifle Barrels—Smooth Bore Barrels—Rifle Actions—Pistol and Gun Actions—Refinishing and Processing—The Stock, Sights and Aids to Accuracy.

34. PISTOL AND REVOLVER SHOOTING, by A. L. A. Himmelwright. A new and revised edition of a work that has already achieved prominence as an accepted authority on the use of the hand gun. Full instructions are given in the use of both revolver and target pistol, including shooting position, grip, position of arm, etc. The book is thoroughly illustrated with diagrams and photographs and includes the rules of the United States Revolver Association and a list of the records made both here and abroad.

35. PIGEON RAISING, by Alice MacLeod. This is a book for both fancier and market breeder. Full descriptions are given of the construction of houses, the care of the birds, preparation for market, and shipment. Descriptions of the various breeds with their markings and characteristics are given. Illustrated with photographs and diagrams.

36. INSECTS ON THE FARM, by E. P. Felt. A practical manual by the New York State Entomologist. He classifies insects—good and bad—according to crops and gives directions for the eradication of the harmful and the encouragement of the desirable. Full descriptions are given of the principal varieties.

37. MARINE GAS ENGINEERING, by A. L. Brennan, Jr. This is a practical manual written from the standpoint of a teaching engineer. All the details of marine gas engine construction and operation are described, step by step, with explanatory diagrams. All technical terms and appliances are fully defined and the latest developments and refinements are traced and described. It is a book for the man who wants to understand and operate his own engine.

38. THE RUNNING HOUND, by Roger Williams. This includes the greyhound and all the decr and staghounds that run by sight alone. The origin of the various breeds is traced and and striking individuals in each class are described. Instructions are given for breeding, care and training for field and show purposes. Illustrated with photographs of types.

39. SALT WATER GAME FISHING, by Charles F. Holder. Mr. Holder covers the whole field of his subject devoting a chapter each to such fish as the tuna, the tarpon, amberjack, the sail fish, the yellow-tail, the king fish, the barracuda, the sea bass and the small game fishes of Florida, Porto Rico, the Pacific Coast, Hawaii, and the Philippines. The habits and habitats of the fish are described, together with the methods and tackle for taking them. The book concludes with an account of the development and rules of the American Sea Angling Clubs. Illustrated.

40. WINTER CAMPING, by Warwick S. Carpenter. A book that meets the increasing interest in outdoor life in the cold weather. Mr. Carpenter discusses such subjects as shelter equipment, clothing, food, snowshoeing, skiing, and winter hunting, wild life in winter woods, care of frost bite, etc. It is based on much actual experience in winter camping and is fully illustrated with working photographs.

41. THE TRAILING HOUND, by Roger Williams. In this book General Williams takes up the hounds that run by scent, such as the foxhound, the bloodhound, and the beagle. He gives full instructions for care in the kennels, feeding, treatment of disease, breeding, etc., and follows it up with directions for training for field and show purposes. Illustrated with photographs of the various types which are fully described in the text.

42. BOAT AND CANOE BUILDING, by Victor Slocum. All of us like to think we could build a boat if we had to. Mr. Slocum tells us how to do it. Designs are given for the various types of canoes as well as full descriptions for preparing the material and putting it together. Small dories and lapstreak boats are also included.

43. BASS AND BASS FISHING, by James A. Henshall. Mr. Henshall has made a special study of the basses in all parts of the United States, a work for which his connection with the Bureau of Fisheries has given him exceptional opportunities. He discusses the habits of the bass and the methods and tackle appropriate for its capture. He also gives in detail the latest facts in regard to the artificial culture and planting of this valuable game fish.

44. BOXING, by D. C. Hutchison. Practical instruction for men who wish to learn the first steps in the manly art. Mr. Hutchison writes from long personal experience as an amateur boxer and as a trainer of other amateurs. His instructions are accompanied with full diagrams showing the approved blows and guards. He also gives full directions for training for condition without danger of going stale from overtraining. It is essentially a book for the amateur who boxes for sport and exercise.

45. TENNIS TACTICS, by Raymond D. Little. Out of his store of experience as a successful tennis player, Mr. Little has written this practical guide for those who wish to know how real tennis is played. He tells the reader when and how to take the net, discusses the relative merits of the back-court and volleying game and how their proper balance may be achieved; analyzes and appraises the twist service, shows the fundamental necessities of successful doubles play.

46. THE AUXILIARY YACHT, by H. L. Stone. Combines information on the installation of power in a boat that was not designed especially for it with the features desirable in designing a boat for this double use. Deals with the peculiar properties of the auxiliary, its advantages and disadvantages, the handling of the boat under sail and power, etc. Does not go into detail on engine construction but gives the approximate power needed for different boats and the calculations necessary to find this figure.

47. TAXIDERMY, by Leon L. Pray. Illustrated with diagrams. Being a practical taxidermist, the author at once goes into the question of selection of tools and materials for the various stages of skinning, stuffing and mounting. The subjects whose handling is described are, for the most part, the every-day ones, such as ordinary birds, small mammals, etc., although adequate instructions are included for mounting big game specimens, as well as the preliminary care of skins in hot climates. Full diagrams accompany the text.

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