STRAWBERRY CULTURE

THESIS BY

FRANK G. CORREGAN

1916

STRAWBERRY CULTURE

THESIS BY

FRANK G. OCORREGAN

C.T.

INDEX

Introduction ----------Page 1
History---------- " 2
Botanical Notes---------- " 5
Species---------- " 6
Chemical Composition---------- " 8
Uses of Fruit---------- " 12
Varieties---------- " 12
Everbearing Varieties---------- " 16
Selection of Varieties---------- " 17
Propagation---------- " 19
Climatic and Soil Requirements---------- " 20
Selection of Site---------- " 21
Preparation of Soil---------- " 23
Planting Systems---------- " 24
Laying out Patch---------- " 30
Plants---------- " 31
Plantimg---------- " 32
Fertilizers---------- " 33
Cultivation and Summer Care---------- " 39
Mulching---------- " 40
Harvesting and Marketing---------- " 42
Treatment after Harvest---------- " 46
Insect Pests and Plant diseases---------- " 48
Yields, Costs and Profits---------- " 50
Fall or Everbearing Strawberry---------- " 53
Selected Bibliography---------- " 57

PROLIFIC

STRAWBERRY CULTURE.

Introduction

The strawberry is one of the most generally distributed crops in cultivation, it being universally grown in all countries having a temperate climate. Probably the reason for this wide range of distribution is its wide range of adaptability both as to soil and climate, its delicious flavor, and finally the small amount of space required to grow it in. According to the 1910 census, more than one half of the acreage in small fruits, including strawberries, dewberries, black berries, raspberries, currants, gooseberries, et al, is in strawberries. The relative value of strawberries to the total of small fruits is even greater.

The leading states in the acreage of strawberries in 1909 were Maryland, Tennessee, Missouri, New Jersey, and Michigan. In production, Maryland and New Jersey led, while in value of crop, New York was first followed by California, Missouri, Maryland, and Michigan, all having a crop valued at $1,000,000 or more. A glance at the states included in the above list will show the wide range of distribution in the United States.

The table below gives the relative production and value of the strawberry crop in New York as compared to the United States.

STRAWBERRY PRODUCTION

	1909			*1899	
	Acreage	Production in quarts	Value	Acreage	Production in quarts
United States	143,045	255,702,035	$17,913,926	151,263	257,437,523
New York	6,382	15,945,863	1,187,410	7,311	13,849,860

*Value of 1899 crop not given.

This would indicate that production is decreasing to a slight extent, but it is hardly likely that the decrease will be permanent.

History.

Several different versions for the name strawberry are given by various authors, the most common being that it arose from the general practice of ancient and modern cultivators of laying straw between the plants to keep the fruit clean and to protect it from the cold. Another version is that the name arose from the custom of children stringing the berries on straws. A third authority claims the name came from stray berries so named because of its habit of sending out runners and seeking shady places.

The exact origin of the strawberry is not

known. Different species have been found growing wild in North, Central, and South America, Europe, and Asia ; in fact, it grows wild in nearly every temperate region of the world.

Just when the strawberry first came under cultivation is hard to tell -- probably in the fifteenth century. It was probably not cultivated in olden times as the early Roman writers on agriculture scarcely mention it. Some of the early writers on culture of fruits do not mention this particular fruit. Pliny, Ovid, and Virgil only casually refer to it as if of minor importance.

We learn, however, that the fruit was growing wild at an early period by references similar to the following lines from Virgil, as translated by Warton.

> "Ye boys that gather flowers and strawberries
> Lo, hid within the grass a serpent lies."

None of the ancient writers give any information of value relating to the culture of the strawberry. We first hear of the strawberry under cultivation in 1483. At this time, the garden of the Bishop of Ely at Holborn in England was celebrated for its strawberries. They were probably the c ommon Wood strawberries of the country, one with red fruit, the other with white. Lyle, in his translation of Drdrens Herball, 1578, mentions only the Wood strawberry. In 1597, Gerade names only the red and white Wood strawberry. In 1623, Bauhin in his "Pinax" lists the White and Red Wood, Alpine, and Hartbor's

strawberries.

A grower at Montreail, France, about 1660, produced a new variety from the seed of the Wood strawberry ; this is the first record of the production of a new variety. By that period, the industry was probably fairly well established in the Old World.

In America, the strawberry was so plentiful in its wild state that its culture was never practiced by the Indians. Some idea as to the prevalence of the wild fruit at an early period may be gained from the following extracts. William Wood in his "New England Prospect", published in 1635, states : "There is likewise, strawberries in abundance, verie large ones, some being two inches about. One may gather halfe a bushel in a forenoone". Later, in 1643, Roger Williams wrote : "This berry (strawberry) is the wonder of all those fruit growing naturally in those parts. It is itself excellent so that one of the chiefest doctors of England was wont to say that God could have made, but never did, a better berry. In some parts where the natives had planted I have many times seen as many as would fill a good ship within a few miles compasse. The Indians braise them in a mottar mixe them with meal and make strawberry bread."

In 1817, Dr. Timothy Dwight, in his volumes, "Travels in New England", gives a list of varieties under cultivation, Red Meadow, White Meadow, Field, Hudson,

and Hautboy, and mentions that he has cultivated the Meadow strawberry for twenty years, indicating that strawberries had been under cultivation in America since 1785 at least.

The first account of the introduction of the South American or Chili strawberry is in 1716, when M. Frezier in his voyage to the South Sea found it near Quito and took it home with him to Marseilles, France. The Spaniards at that time claimed they had previously brought it from Mexico. From this time on the Chilian strawberry assumed more or less importance in the cultivation of the fruit.

Botanical Notes.

The strawberry is an herbaceous perennial. It naturally propagates itself by means of runners or serpentine layers that form chiefly after blooming season.

It is a member of the family Rosaceae, tribe potentilla, order fragaria.

Botany and Species.

The general characters of the strawberry are as follows : calyx, flat or reflexed, deeply five-cleft, with the same number of bractlets, thus appearing to be ten-cleft. Petals, five, white, erect, spreading. Stamens, many, usually about twenty. Pistils, numerous

adhering at the base to the small seed-like fruits, these are situated on the fleshy receptacle, which enlarges and becomes the fruit or berry. Increased by seeds, runners, and divisions of the roots. Stemless perennials, with or without runners. Leaves, radical, divided into three leaflets, obovate wedge-form, coarsely serrate, evergreen. Roots, fibrous, rather woody, perennial.

FRAGARIA CHILOENSIS

Species.

1. Fragaria chiloensis Duchesne -- the Chilian or Garden Strawberry. This species is a native of the west coast of both North and South America. The cultivated strawberry is probably a direct descendent of this species.

Large flowering strawberry. Calyx, erect, slightly spreading. Flowers larger than other species. Fruit, sweet, perfumed. Flesh, firm. Flower stalks

shorter than leaves. Seeds set in shallow depression.

Varieties : Dunlap, Chesapeake, Glen Mary, Marshall, Prolific, Sample, Brandywine.

FRAGARIA VIRGINIANA

2. Fragaria virginiana Duchesne -- Common Virginian or Scarlet Strawberry. Native of North America, chiefly United States and southern portions of Canada.

Seeds imbedded in deeply pitted receptacle. Fruit, roundish to conical, highly perfumed. Flower stalks shorter than the leaves, hairy ; hairs spreading, more or less erect. Leaves, obovate, wedge-form, variable, coarsely serrate, usually dark green ; upper surface smooth, often shining.

3. Fragaria vesca, Linn. -- Wood or Alpine Strawberry. Native of Europe and America.

Seeds superficial, on the conical or hemispherical fruiting receptacle. Flower stalks longer than the leaves, erect, hairy ; hairs closely pressed upwards. Fruit drooping, usually conical, sometimes globular. Leaves, thin, pale green, upper surface uneven, slightly wavy.

4. Fragaria meschata Duchesne -- F. elatoir -- Haulbois Strawberry. Native of Germany.

Calyx reflexed. Seeds superficial. Flower stalks longer than the leaves, erect. Fruit, round or oblate, usually drooping, but sometimes erect possessing a strong musty flavor. Hairs on both leaf and flower stalk long and widely spreading, somewhat reflexed. Leaves larger than in F. vesca, and more or less pubescent, covered with short hairs on both upper and lower surface giving them a rough appearance.

Chemical Composition.

The strawberry cannot be considered as a very nutritious food, carrying but little over ten per cent dry matter.

The results of analysis made at Oregon are given in the table on the following page.

Composition of Strawberry.

Variety	Ave. Weight Grams	Flesh Percent	Waste (Hull)	Sugar - - - - - Percent			Acid as Malic	Nitrogen	Albumenoids N x 6.25	Approximate Composition.			
				Grape	Cane	Total				Water	Organic Matter	Ash	Total
Michaels Early	2.39	94.47	5.53	3.07	1.59	4.66	1.08	.10	.62	91.52	8.15	.33	100
Veck	10.66	97.27	2.73	3.21	.93	4.14	.95	.18	1.12	81.70	17.91	.39	"
Warfield	6.66	96.80	3.20	3.94	1.08	5.02	.89	.11	.69	90.45	9.18	.37	"
Glendale	11.30	97.00	3.00	3.27	.88	4.15	1.01	.18	1.12	88.23	11.45	.32	"
Sharpless	5.55	97.54	3.46	—	—	6.18	.72	.18	1.12	88.22	11.42	.36	"
Wilson	4.86	97.59	2.41	—	—	5.90	.80	.12	.75	88.14	11.20	.66	"
Pre Eugene	6.96	96.56	3.44	—	—	10.00	40	.10	.62	87.30	12.12	.58	"
Maryoon	11.33	97.36	2.66	-	—	6.18	.19	—	—	88.72	10.79	.49	"
Clark's Seedl	8.43	95.36	4.64	5.44	.62	6.06	—	—	—	89.02	10.69	.25	"
Average		96.66	3.34	3.79	—	5.80	.75	.17	.86	89.57	11.43	.41	"

The following table gives a comparison of results obtained by different investigators.

	Water	Dry Matter	Pro-tein	Total sugar	Acid	Fibre	Ash
European (J. Konig)	87.66	12.34	.57	6.28	.93	2.32	.81
Tennessee W. E. Stone	90.52	9.48	.99	5.36	1.37	1.55	.62
Ohio H. A. Webber	-----	----	--	4.50	1.00	----	---
Oregon G. W. Shaw	88.57	11.43	.86	5.80	.75	----	.41

From this it appears that the European berry is probably sweeter than the American berry ; yet this would be governed by the variety used in the analysis. They do not appear so rich in protein and probably carry more fibre. Comparing ratio of acid to sugar European gives 1 to 7, while American 1 to 5. If this be compared to the ratio for wild strawberries as stated by Fresenius, 1 to 2, it is seen there has been quite an important change brought about by selection and cultivation.

Strawberries have less food value than do stone fruits ; they approximate vegetables in their nutritious properties as may be seen from the following table.

	Water	Dry Matter	Pro-tein	N. Free extent including fat & fibre	Ash	Acids as SO_3
Fresh Prunes	77.37	23.46	1.14	21.14	.83	.35
Plums	78.40	21.60	1.00	20.10	.50	.40
Cherries	81.30	18.70	.90	17.30	.50	---
Potatoes	78.30	21.70	2.20	17.50	1.00	---
String Beans	89.20	10.80	2.30	7.70	.80	---
Turnips	90.46	9.54	1.14	8.63	.80	---
Strawberries	88.57	11.43	.86	9.41	.41	---

A study of the composition of the ash from strawberries is interesting since it indicates in a general way what elements are removed by the strawberry crop. The table below shows the composition of the ash and pounds different elements removed per 1,000 pounds of fruit for strawberries as compared with some other fruits.

Fruits	Total Ash Per Cent	Percent in Total Ash			Per Cent Nitrogen	Pounds Removed in 1000 Pounds Fruit				
		Potash	Phosphoric Acid	Lime		Total Ash	Potash	Phosphoric Acid	Lime	Nitrogen
Prunes	.64	15.88	13.49	4.66	.168	6.4	3.76	.98	---	1.68
Cherries	.54	37.60	10.70	1.08	.175	5.5	2.00	.58	.05	1.75
Strawberries	.51	44.93	18.65	4.20	.170	5.1	2.34	.85	.18	1.70
Apples	.39	48.72	2.56	----	.130	3.9	1.90	.10	---	1.30

From the above table it will be seen that strawberries draw heavily on the potash and nitrogen of the soil, the former constituting about two-fifths of the entire ash.

Uses of Fruit.

The strawberry has been used mainly for table and dessert purposes up to the last few years. Lately, however, it is coming more and more to be used in flavoring ice cream, etc., and for canning. The use for which the fruit is intended will influence the varieties grown, some being preeminently dessert berries, others being suitable for canning and preserving.

Varieties.

There are innumerable varieties of the strawberry, many of which are considered the best in their respective localities.

For the New York grower, the following varieties may be recommended, but it must be remembered that different varieties do best under different conditions.

I. Senator Dunlap -- Perfect. Originated about 1890 by J. R. Reasoner, Urbana, Ill. Introduced by M. Crawford, Cuyshoga Falls, Ohio, in 1899. Plants very numerous, vigorous, healthy, very productive. Leaves medium size. Blooms mid season, ripens slightly before mid season, picks easily. Calyx medium, reflexed. Seeds medium or above. Fruit very large to medium, drops in size as season advances, glossy, attractive, light, and dark scarlet. Flesh well colored, medium to firm, rather mild; pleasant flavor; quality good.

Inclined to produce too many plants. Although somewhat variable in size, is desirable on account of general attractiveness and desirable flesh characters.

II. Sample -- Imperfect. Plants vigorous, healthy, productive. Fruit large, crimson. Flesh tinted, fairly firm, juicy; quality fair; season very late. A first class market berry.

III. Marshall -- Perfect. Originated in 1890, introduced in 1893 by M. F. Ewell, Marshfield Hills, Mass. Plants medium in number, medium to vigorous, considerably injured by leaf blight, rather unproductive, leaves somewhat large, blooms and ripens in mid season, picks easily. Calyx medium size, somewhat depressed. Seeds slightly raised, rather large. Fruit very large to above medium when well grown, otherwise varying to below medium, attractive, dark scarlet. Flesh well colored, firm, juicy, pleasant acid, of high flavor, good to very good. Unless well ripened berries are inclined to have greenish tips. A standard commercial variety, variable in certain locations, not succeeding generally. Requires high culture.

IV. Glen Mary -- Perfect. Origin, chance seedling found by J. A. Ingram, Pennsylvania. Plants vigorous, healthy, productive, propagates readily. Fruit large to very large, dark, crimson, flesh pink and white, firm, slightly acid. Quality, dessert fair, canning good. Season medium to late.

V. William Belt -- Perfect. Origin, William Belt, Ohio. Plants large, strong, productive, sometimes rusts badly. Fruit large to very large, bright scarlet, flesh pink and white, sub-acid, good to best, medium to late season. Does not endure drought well.

VI. Warfield -- Imperfect. Origin, chance seedling found by B. C. Warfield, southern Illinois. Plants small but rampant grower, too many runners often filling rows too thickly, succeeds best on moist soils and in showery seasons, often a failure on very dry soils. Blooms early, very productive. Fruit medium dark, rich crimson, firm. Good shipper, excellent for canning, sub-acid, very good quality, season early to mid season.

VII. Brandywine -- Perfect. Origin, seedling raised by E. Ingram of Pennsylvania, introduced in 1894. Plants very vigorous, productive, fruit large, crimson, flesh firm, rather acid, good quality, season medium to late.

VIII. Rough Rider -- Perfect. Bubach X Gandy. Originated in 1893 by Chas. Learned, introduced in 1900 by L. J. Farmer, Pulaski, N. Y. Plants medium in number, moderately vigorous to vigorous, slightly attacked by leaf blight, below medium in productiveness, leaves medium size and color, blooms slightly past mid season, ripens rather late, picks easily, calyx medium to below in size, sunken, seeds depressed, fruit large to above medium, good size through season, rather dark, attractive

scarlet, flesh well colored to center, firm, agreeably acid, pleasant flavor, quality good. A desirable late variety on account of size, attractiveness, and good characters of flesh.

IX. Chesapeake -- Perfect. W. F. Allen, Salisbury, Md. Plants rather few, vigorous, usually healthy, but with a tendency to mildew, productive, leaves above medium in size, flowers perfect, season of bloom late, calyx large, leafy, attractive green, slightly depressed ; seeds conspicuous, often markedly raised, numerous. Fruit matures in mid season, or later, ripening period of medium length, easily picked, ships well ; berries large, dropping in size as season advances, beautiful, glossy scarlet, flesh very firm, mildly acid, juicy, pleasant flavor, good to very good in quality.

X. Prolific -- Perfect . Plants numerous, vigorous, very productive, somewhat susceptible to leaf spot, leaves large, wide ; flowers perfect, intermediate in time of bloom ; calyx medium to below in size, depressed, seeds numerous, somewhat raised, fruit matures in mid season, ripening season long, easily picked, berries very large, retain size, handsome, bright scarlet, flesh firm, well colored at the center, juicy, pleasantly acid, aromatic, of good quality.

XI. Barrymore -- Perfect. Originated by H. L. Crane, Westwood, Mass., in 1901, introduced by him in 1908. Plants numerous, medium in vigor and height, very productive, somewhat subject to attacks of leaf spot,

leaves rather small, flowers perfect, bloom rather late, calyx large, flattened, fruit matures medium early, season long, fruit large, retains size fairly well till near the close of the season, glossy, dark red, seeds raised, flesh well colored to the center, juicy, firm, pleasant flavored, sprightly, very good in quality.

XII. Gandy -- Perfect. Origin, New Jersey. Plants vigorous, healthy, a shy bearer, fruit large, glossy crimson, flesh pink, firm, very good, quality very good, excellent for canning, excellent shipping berry, season very late.

Everbearing Varieties.

Americus - Rockhill No. 2. (Originated by Harlow Rockhill, Conrad, Ia.) Flowers perfect ; plants few, below medium in size, unproductive ; leaves medium, calyx small, slightly depressed ; seeds raised ; fruit ripening late, medium size, light red ; flesh firm, mild, sub-acid, fair quality. The plants lack in vigor and productiveness and the fruit, although a good shipper, is inferior in size,color, and flavor.

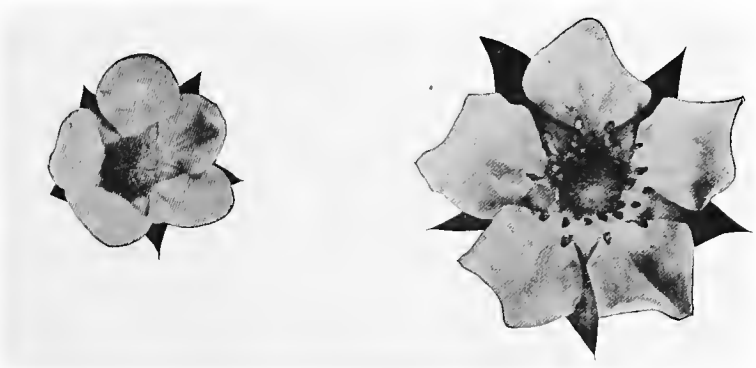
Francis. (Originated by Harlow Rockhill, Ia.) Flowers perfect, plants small, vigorous, leaves medium, fruit irregular in shape, large, bright, glossy color, quality good. Young plants are small and inclined to be fairly good growers when once started, however.

Pan American. (Originated by Samuel Cooper,

Catteraugus Co., N. Y.). Perfect. The first fall strawberry of American origin. Plants strong, vigorous growers, productive, leaves medium, fruit good color, quality good, plants and fruit susceptible to mildew.

Selection of Varieties.

The profitableness of a variety varies with different environments and surroundings. Adaptations should be determined by tests with a few plants before using in a commercial plantation, and by this method the best suited varieties determined. The market will have an effect on the varieties planted, a distant market necessitating varieties that will hold up well under shipment ; the market may demand early or late varieties. If growing for canneries, these demands must be considered. Probably the greatest single factor in the choice of varieties is sexuality.



IMPERFECT OR PISTILLATE FLOWER

PERFECT FLOWER

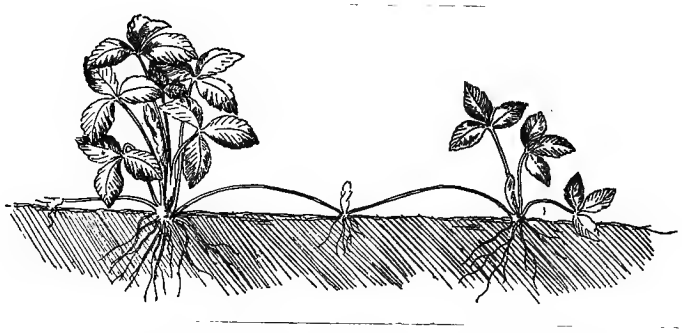
The strawberry is a somewhat peculiar plant in that different varieties produce different kinds of flowers. Some varieties, as Senator Dunlap, are perfect flowered, that is, they bear both male and female organs and are capable of self-fertilization. Other varieties, such as the Warfield, have only pistilate or female organs in the flowers, hence in order to produce fruit must receive pollen from some other or staminate variety. If an imperfect variety is grown, care must be used to select a perfect variety to be planted with it. They should be set in from one to three alternating rows to insure fertilization. The perfect and imperfect varieties should bloom at the same time and preferably the perfect should have even a longer blooming season than the imperfect so that ripe pollen will be available at all times.

Bees and other insects visiting perfect flowers become more or less covered with pollen, which is left on the pistils of the next flower they visit. Incomplete fertilization is usually indivated by the presence of nubbins, berries with hard, greenish, undeveloped apex. Too much rain, frost, or cool temperatures, at blooming time, or the absence of insects, may greatly decrease the set of fruit.

Propagation.

The strawberry is one of the easiest plants to propagate. There are two ways by which it may be propagated that are of value, first, by seeds, second, by runners.

The first process, by seeds, is common with the wild berries. When the fruit matures and the seeds drop to the ground, they are partially covered, and if conditions are right they will germinate and produce a new plant that summer ; otherwise, the following spring. Propagation by seed is used by breeders in the production of new varieties.



REPRODUCTION BY MEANS OF RUNNERS.

For commercial growers, the second method, propagation by runners, is practiced. In this method, the mother plants are set out in rich, well prepared soil and allowed, in fact encouraged, to produce runners. The finer the condition of the soil, the better the rooting system that will be developed by the young plants.

It is claimed, generally, that the first plant on a runner is the best ; it probably will be larger in fall because it has a longer time to develop, but for ability to produce fruit, probably the second or third plant is just as good.

It is better to restrict the production of new plants by the parent ; few runners, with not more than two plants to each should return larger and healthier plants in the fall.

After the new plants have become firmly established, the runner from the parent is broken, and from then on the young plant must make its own way. At this time, the young plant may be moved to its new bed. Examine plant and make sure that roots are uellow to whitish colored. This indicates a young plant; if roots are black it is a sign that the plant is an old one. Larger and better fruit is produced on the young plants.

When the mother plant is producing plants, all blossoms should be pinched off and not allowed to fruit, as a good crop of young plants and a good crop of fruit can not be produced at the same time.

Climatic and Soil Requirements.

The strawberry has adapted itself to such a wide range of climatic and soil conditions that is is impossible to state what are the best general conditions for its culture. It is under cultivation in nearly every state

in the Union. The succeeding discussion covers what appears to be the best conditions and practice for New York State.

Selection of Site.

The selection of a site for the strawberry patch is governed by several different factors, such as climate, slope or exposure, drainage, kind of soil, and the condition of the soil.

The strawberry is adopted to a wide range of both climate and soils, hence it will be found growing throughout the United States.

The site of the patch should be level or at most gently sloping and should never be located at the bottom of a slope, otherwise the danger of frost injury will be considerably increased. With a gentle slope the tendency of the cold air will be to move downwards and not settle over the plants. The strawberry is much more liable to suffer from frost injury than other fruits because of its being a low growing or prostrate plant.

A gentle slope is also desirable in that it insures good drainage. The strawberry makes its best growth on well drained soils, only a few varieties being able to withstand wet, soggy soils. A southern slope will tend to produce an earlier crop and consequently should be avoided where there is danger from late frosts. In the latter case, a northern slope should be chosen. With southern slopes, heaving, resulting from alternate

freezing and thawing, is more likely to occur than on the colder northern slopes.

Since the strawberry bed is kept clear of weeds only with difficulty, one prominent grower in Oswego County, N. Y., advises selecting a site near the house and the public highway ; the house, because then the farmer will utilize his spare hours to good advantage in hoeing and caring for the patch ; near the road, because he will naturally desire to have his patch show off to the best advantage, hence as a matter pride will take better care of the patch.

Soil.

Most any good soil will grow strawberries to some extent. Like other crops, however, they have their preferences. Light sand and gravel are best for early berries and such varieties as Stevens and Clyde will be found doing well on them. William Belt, Parsons, and Glen Mary, will do well on heavier soils. Heavy clay is hard to handle but when well drained it will produce the largest crops and the largest berries. In Oswego County, some of the best crops are produced on a loam so stony that there is hardly room for the plants to develop. The ideal soil is probably a well drained, rich, clay loam containing a good supply of humus.

Some of the qualities necessary in a soil to

obtain good results would be, ability to retain moisture. since the production of heavy crops demands a large supply of water. Under ordinary conditions, rains at fruiting time are insufficient. This is especially true if the soil is such that the greater part of the water is allowed to run off. The soil should be in condition to catch and hold the moisture. The soil texture and its organic content are controlling factors in this.

A large part of the water held in the soil is in thin layers surrounding the soil particles, hence the greater the number of these particles the greater the water holding capacity of the soil. Lumpy, cloddy soils will lose their moisture much more readily than those of fine tilth. Decaying vegetable (organic) matter in the soil increases its water holding capacity. It is also beneficial in that it assists in liberating food for the growing plant and fruit. The plant food content of the soil should not be overlooked ; comparatively fertile soils are most desirable. If the soil is ideal in other respects, deficiency in plant food should not deter one as this may be overcome.

Preparation of Soil.

If soil is wet and soggy, it must first of all receive proper drainage. The time of plowing is next to be considered. Fall plowing has several advantages

over spring plowing in this State, the most important of which are : land is sure to be ready for spring planting, if fall plowed, and plants can be set out in weather that would be too wet for spring plowing ; also, by fall plowing various insects are better controlled and weeds kept down.

On the other hand, fall plowing may result in loss of soil and plant food erosion or the soil may become too dry. Contrasted with fall plowing, spring plowing offers the following advantages : harrowing and planting immediately follow plowing, decreasing the loss of soil moisture ; permits a cover crop to remain on over winter, stopping erosion. On sandy soils, spring plowing should always be practiced. The harrowing should be done as soon as possible in the spring, and should be very thorough. Harrowing should first be done with a disk harrow, and later with a spring tooth harrow, both ways of the field. It should be set to dig quite deep but this should be decreased to about one inch at planting time because the strawberry being a shallow rooting plant it is desirable to have the soil moist as near the surface as possible. This is accomplished by having a shallow soil mulch.

Planting Systems.

Three more or less distinct systems of planting are in use, but these are subject to various modifications to suit the whims of the grower.

HILL SYSTEM OF CULTIVATION

The hill system is distinct from all others in that only the original plant is allowed to develop, all runners being pruned off as fast as they appear. Rows and plants are closer together than in any other system. The chief advantage claimed for it is the greater size of fruit. The labor cost is very high in comparison with the other systems.

There are two hedge row systems, the single and the double. In the former, two runners are taken from the mother plant and placed in the row on either side of the mother plant. The plants are set in rows two to three feet apart, the plants being twenty to thirty inches apart in the row. The double hedge row is a development of the single hedge row, in which the mother plant is allowed to set six runners two being placed as in the single hedge row and the others at an angle of sixty degrees on either side. These plants are trained to form three rows, one being in line with the older plants, and a row on each side of the mother plant.

The plants are set thirty inches apart in the row, the rows being three feet apart. Some of the advantages claimed for this system are : permits ease in hoeing and cultivation ; eliminates crowding and allows plenty of sunlight and air to reach each plant.

MATTED ROW CULTIVATION.

The matted row system is the most popular with the commercial grower as it gives the greatest yield for the least expenditure of labor. In this system not only are the first runners used, but if necessary a second plant from the runner as well. The runners are allowed to develop as many plants as they will, the runners usually being spread about six to eight inches apart until they take up the entire area devoted to the row. Both wide and narrow matted rows are used, differing only in their width, the former being from twelve to eighteen inches wide, the latter two feet or

over. In cultivating, the machine is run in only one direction, and as the plants spread the cultivated space narrows down to twelve or fifteen inches.

The following data from the results of an experiment conducted by the Ohio Experiment Station indicates the advantage of matter row over the hill system. In 1910, a dozen varieties were selected for hill and matted row culture. For hill culture, rows were thirty feet long and contained twenty plants.

Variety	Yield 20 Hills, 30 Feet	Matted Row 18 Feet
	Quarts	Quarts
Sample	6 2/3	10 7/12
Ekey	3 3/4	6 1/6
Buster	13 1/3	26 1/2
Stevens Late Champion	6 2/3	9 11/12
Marshall	5 7/12	4 (Thin stand)
Senator Dunlap	6 7/12	3
Highland	10 2/3	10 1/12

The average per foot per row for the twelve varieties when the plants were set one and one-half feet apart was three-fourths of the average yield when grown in the matted row.

Hill culture produces earlier berries, the average being one and one half days for the first picking and seven days earlier for the last picking. No variety lasted as long in hill culture as in the matter row.

The difference between plants varies primarily with the ability of the plant to produce runners, the system of planting, and method of tillage. The distance between plants in the row, except in the hill system, is most largely dependent upon the ability of the plant to produce runners. Some varieties, like Senator Dunlap, throw out numerous long runners and will need to be planted farther apart than Gandy, Rough Rider, and other shy plant-makers. Distance between plants in the row varies from fifteen to thirty inches.

The distance between rows varies with the system of planting and tillage. Where hand tillage is practiced, rows in the hill and single hedge system may be thirty inches apart. Thirty inches is about the minimum for the double hedge row and the narrow matted row, and three feet for the wide matted row. If horse cultivation is used, these distances should be increased to six to twelve inches.

The following table gives the usual distances for the various systems.

DISTANCE BETWEEN ROWS AND PLANTS

System	Distance Between Plants	Distance Between Rows
	Inches	Feet
Hill	12 - 18	2.5 - 3
Single Hedge	18 - 30	3
Double Hedge	18 - 30	3 - 3.5
Matted row - narrow	18 - 30	3 - 3.5
Matted row - wide	18 - 30	3 - 4

The number of plants per acre will depend upon the system of planting. The table below gives the number per acre.

NUMBER OF PLANTS PER ACRE PLANTED IN HILLS, DOUBLE HEDGE AND MATTED ROW SYSTEMS

Distance between Plants (Inches)	Rows (Feet)	Plants
12	3	14,520
12	3.5	12,445
18	3	9,680
18	3.5	8,298
18	4	7,260
24	3	7,260
24	3.5	6,223
24	4	5,445
30	3	5,808
30	3.5	4,979
30	4	4,356

By means of the following simple rule, the grower can easily determine the number of plants for any system per acre. Divide 43,560 by the product obtained by multiplying the distance between plants, in feet, by the distance between rows, in feet.

Example : If it is desired to set plants in rows three feet apart, plants one and one half feet in rows.

3 1/5 = 4/5

43,560 ÷ 4.5 = 9,680 plants required.

Laying Out Patch.

Any method that will give straight rows may be used in laying out patch. Straight rows not only look better but they make planting, cultivation, picking, and all other operations, easier. In some cases the rows are located by shallow furrows, made with a plow, but these are seldom straight and increase the cost of planting ; besides ridges are left throughout the field where furrows were turned up.

A good method is to line in stakes along one side of the field and then follow the first mark with a horse marker. The common corn marker may be used if set at proper distances. A marker may be easily made of 2x3" scantling, 12-15' long, with pegs fastened at intervals at which rows are desired. These can be made to be drawn either by hand or horse. By keeping the

outside of marker in first row the succeeding rows will always be straight with it.

Plants.

The plants may be secured from any reliable nurseryman. In ordering, specify that new plants are desired, otherwise you may receive some old ones.

As soon as plants arrive, they should be unpacked, moistened, and placed in a cool cellar or shed. Examine the roots of the plants. If they are black or dark colored, do not take them as they are old plants. The best plants should have light yellow to orange colored roots. In case planting is not to be done immediately, the plants may be healed in ; that is, trenched in close together in the garden and protected from sun and wind by some sort of covering.

TRENCHING OR HEELING IN PLANTS.

Planting.

Planting may be done either in the spring or late summer. Nothing is gained by fall planting, and due to the liability of drought, the chances of failure are greatly increased. With fall planting, protection through the winter must be provided before a full crop is secured.

Spring setting is usually preferable in New York State, as it shortens the time from planting to fruitage and at the same time secured better weather and soil conditions. Spring planting may be begun as soon as soil and plants are in good condition for the work. Planting at this time also gives an opportunity to greatly reduce the number of weeds by thorough cultivation after growth begins and before setting the plants.

Pruning is usually necessary before setting the plants. It consists in reducing the top and shortening the roots. Top pruning is usually done at planting. All dead leaves and all but one or two small healthy leaves should be removed. These will be sufficient for the needs of the plant at that time ; a larger number is apt to result in excessive transpiration.

Root pruning consists in cutting off one-third to one-half of the root system. The extent of pruning

depends upon the vigor of the roots, being greater for vigorous and less for weak plants. Root pruning is usually done when the plants are heeled-in. If plants are to be left heeled-in for any considerable time, root pruning should be deferred until planting time.

Three things are essential in setting strawberry plants :

1. The plants must be set at the proper depth.

2. The soil must come in firm contact with the roots.

3. Roots must not be allowed to become dry during the operation.

The plant should be set so that the soil covers the base of the crown of the plant ; deeper planting covers the crown and the bud may not be able to push out of the soil, while shallow planting leaves the upper portion of the roots exposed. These soon dry out and the plant is killed. The soil should be firmed against the roots so that all points of the root are in contact, otherwise the plant will not be able to obtain enough water to support it. Better results are obtained if roots are spread out when planting is done.

If roots are allowed to dry out during planting, it is usually fatal. Some means should be provided for keeping them moist. One way is by carrying them

to the field in a pail with the roots immersed in water, or they may be wrapped in a wet cloth. If a boy is employed to drop the plants ahead of the planter, he should not be allowed to get more than two or three plants in advance.

There are various methods employed in setting out the plants, among the most common being the trowel or dibble, and the spade. In either case, the work must be carefully done to obtain satisfactory results.

In dibble planting, each planter works independently ; the dibble is thrust into the soil and by a sidewise movement an opening is made for the plant. The roots are thrust into the opening and the plant lowered somewhat below the height at which it is to stand. It is then raised to its permanent position so that the roots may be well spread out and placed naturally instead of being crowded into a bunch. The dibble is then thrust into the soil at a slight distance from the plant and the soil crowded firmly against the roots. The second opening may be filled by knocking loose earth into it.

Planting by the spade method requires two men working together, one to handle the spade and one to prune and set the plants. A smooth, bright spade is necessary as the soil will stick to a rusty one. The

spade is thrust into the soil from two-thirds to three-fourths the length of the blade, the back of the spade being away from the operator. An opening is made in the soil by a forward and backward movement. The spade is then either wholly or partially removed, depending upon how great a tendency the soil has to fall into the opening. The man placing the plant works from the opposite side of the row. He grasps the plant between his thumb and the palm of his hand, and using his fingers to spread the roots, inserts them into the opening with a sort of swinging motion. The spade operator then pushes the spade into the soil about two inches from the plant forcing the soil against the roots. At the same time the man who places the plant presses the soil on the opposite side with his foot which insures a good contact between the soil and the roots. As with the dibble method the second hole made in planting is then filled.

If the grower has used the furrow method of marking out his strawberry bed, he may set the plants as follows : The plants are set in the furrow and soil placed around the roots either with a trowel or the hands. The soil is firmed into place by using either the feet or the knees. There will remain a large amount of soil to replace ; this may be done with

a shovel toothed cultivator at very little cost.

Fertilizers.

Large crops of strawberries are produced only by the removal of considerable plant food from the soil. If the elements required are not present in the first place, there can be no large crops. Growers will have to determine the limiting factors for themselves by field trials and then supply the necessary element or elements.

There are three common methods of fertilization open to the grower, by the use of (1) manure, (2) commercial fertilizer, (3) a combination of the two. It is generally that for ordinary conditions, stable manure is the best. Manure possesses several qualities that make it desirable for use. It not only increases the available plant food, but also supplies all the necessary elements, apparently in sufficient quantities in most cases. It also, as has been said, increases the organic content and water holding capacity of the soil.

By the use of commercial fertilizer, one or more elements may be supplied as needed. This is advantageous where a soil is noticeably lacking in one element. In most cases it is probably more economical to use commercial fertilizer in this way, rather than as a complete fertilizer. Practically all soils if properly worked possess sufficient available potassium. Nitrogen is probably best supplied by using stable manure or green manuring crops. Therefore only phosphorus and lime need be supplied by commercial fertilizer

generally. Some growers claim strawberries do better on an acid soil, hence there is some question as to the use of lime since its purpose is to correct acidity. The question of the strawberry doing better on an acid soil has never been carefully worked out, this should be done before it is generally recommended.

The amount of fertilizer to be applied will, of course, vary with the soil and the grower. Some growers believe there is little or no danger of getting the soil too rich, othere, that enough is as good as a feast, and apply it accordingly.

The amount of manure applied will vary from four to forty loads an acre, with an average often to fifteen loads. By using a complete fertilizer a 3-7-9 mixture is considered good, that is one containing 3% of nitrogen, 7% of phosphoric acid and 9% of potash. This may be bought ready mixed, or the ingredients purchased and home mixed. The latter is the cheaper. The table below gives the quantity of various common fertilizers necessary to furnish the desired amounts of plant food.

Some Fertilizers & Suggested Rates of A pplication.

Fertilizer	Present Strength	Pounds per Acre	Pounds element
Nitrate of Soda	15 N	200-350	30-52 N
Sulphate of Ammonia	20 N	150-250	30-50 N
Dried Blood	14 N	200-350	28-49 N
Murrate of Potash	50 K_2O	150-250	62-104 K
Sulphate of Potash	48 K_2O	150-250	60-100 K
Bone Meal	21 P_2O5	250-500	23-46 P
Acid Phosphate	15 P_2O5	350-700	23-46 P

N - Nitrogen ; K_2O - Potash ; P_2O5 - Phosphoric acid ; K - Potassium ; P - Phosphorus. From Wise, 248.

In mixing these materials to make the 3-7-9 fertilizer recommended, it is possible to adjust the proportions in various ways. Two such mixtures are given below.

Suggested Fertilizer Mixtures.

Fertilizer	Per Cent Strength	Amount in pounds	Pounds of plant food
Nitrate of Soda	15 N	100	15 N
Acid Phosphate	15 P_2O5	225	35 P_2O5
Sulphate of Potash	48 K_2O	95	45 K_2O
Dried Blood	14 N	150	21 N
Bone Meal	21 P_2O5	125	49 P_2O5
Murrate of Potash	50 K_2O	180	63 K_2O

From Wise Bul. 248

There is practically no danger from increasing any of the elements, except nitrogen. Nitrogen in excess has a tendency to cause excessive vegatative growth at the expense of fruit production.

The time of application of fertilizer depends upon the kind of material used. Manures and slowly available fertilizers should be applied to the preceding crops. Readily available fertilizers should be applied just before results are desired. Commercial fertilizers may be distributed broadcast and harrowed in just before setting the plants, or scattered along the rows after planting.

After a three-year experiment conducted in co-operation with different growers, the Missouri Experiment Station recommended the following for light, gravelly soils on which experiment was conducted, 250-300 pounds of acid phosphate, or probably steamed bone meal, be used, preferably one year before the crop is harvested, on all but the very richest strawberry soils ; that no form of nitorgen-bearing fertilizer be used except on a small tried plot ; that potassium be used only on small tried plots.

Cultivation and Summer Care.

Cultivate immediately after planting. This will help to consume moisture, increase the available food supply, and destroy the weeds.

The conservation of moisture during the summer months is the most important result of proper cultivation.

Loss of soil moisture is much greater when soil is allowed to become compact at planting time or later. Cultivation breaks the capillary relation of upper soil and protects the moisture with a dust mulch. Frequent cultivation is necessary to do this. Cultivating every two weeks gives good results where possible. Cultivation should be shallow, one or two inches, otherwise, the roots of the strawberry plant which are always near the surface will be injured. Cultivate two ways until the formation of runners confines it to one direction. Hoeing about the plants immediately after setting gives very good results. Cultivation should be continued until growth stops. Plants should not be allowed to fruit the same season as planted, or the first season after planting if set in the Fall. The first year should be devoted to producing good, vigorous crowns and strong runners, hence buds or blossoms should be removed as soon as possible after being formed.

The best runner plants should be selected as soon as possible, they will plant in July. The distribution of runners will depend upon the system of planting. In matted rows the runners should not be closer than from six to eight inches.

Mulching.

Mulching is necessary to protect the plants during the winter months from sudden changes in temperature, to protect them from heaving in the Spring when alternate freezing and thawing would tend to throw the plants out, to keep down weeds by smothering them, to conserve the moisture and finally

to keep the fruit clean.

A good mulch should be free from weed seed, spread evenly and break up readily in the spring. Various materials such as wheat or oat straw, strawy horse manure, mash hay etc., are commonly used for a mulch. Manure and mash hay do not break up as readily in the spring as does oat and wheat straw, but manure has the big advantage that it furnishes plant food. Oat straw is liable to contain many weeds, so should be used with care.

Generally, the mulch is applied in the fall after the ground has frozen so that the plants are not injured by driving over them. Some growers, however, prefer to apply it before freezing, claiming that there is less danger of injury to the plants.

The depth of the mulch will, of course, vary with the different conditions. As a common practice an inch and a half to three inches should be enough, this will furnish all the protection required, and more might smother the plants.

The time of removing the mulch will depend upon the weather conditions in the spring. By leaving the mulch on, blossoming may be retarded until all danger of frost injury is past. The mulch may also be used as a means of delaying fruiting by leaving on, in this case it should be left on until first leaves push through the mulch.

If the mulch be a light one, about all that will be necessary is to loosen it up some, so that plants may push through. If heavy, some must be raked off and placed between

the rows. If the rows are too close, it may be necessary to draw some mulch from the field.

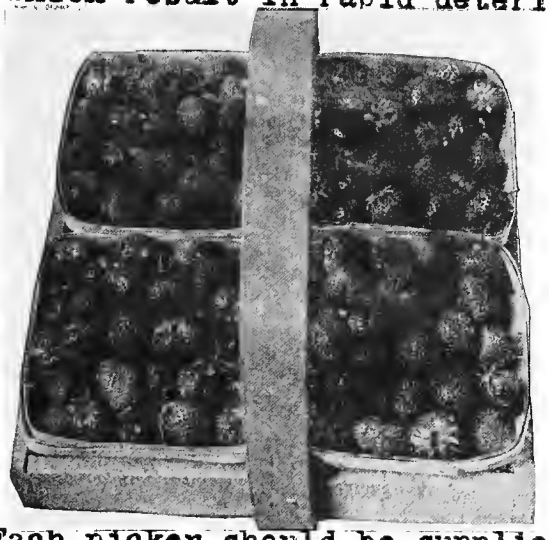
All the mulch should not be removed from the plants. The plants should grow up through enough mulch to keep the ripened fruit from coming in contact with the soil. If chunks of mulch are left over the plants, injury is very likely to result.

Most growers let the mulch conserve the moisture and keep down the weeds until after fruiting. A few, on the other hand, practice cultivation as soon as soil is fit to work until berries are half grown. In latter case mulch must be removed and then replaced before fruiting time. At this time any large weeds should be pulled, care being taken not to pull the strawberry plants up at the same time. The weeds will pull much easier when the soil is wet after a heavy rain.

Harvesting and Marketing.

Harvesting is one of the most important operations connected with strawberry culture, primarily, because of the difficulty of securing reliable pickers. The strawberry must be handled carefully, if it is to reach the market in good condition. This is something the average picker does not seem to be able to realize. The berry should be picked by pinching off the stems, but the stems should not be left over one-quarter of an inch in length. Pulling the berry from the plant should not be allowed, as many berries will be partly crushed and the stem and the calyx pulled out, either

or both of which result in rapid deterioration of fruit in transit.



FOUR QUART CARRIER.

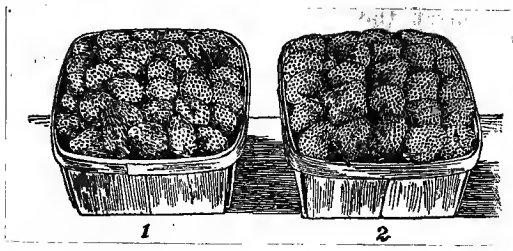
Each picker should be supplied with a carrier holding from four to six quart boxes, six when the picking is in full swing, four at the beginning and end of the season. The fruit should be placed in the shade as soon after picking as is practical. Strawberries left in the sun will spoil in a very short time.

Grading should be done by special force, the average picker not being trustworthy enough to do it as he or she picks, although some growers attempt to have the pickers grade the fruit as it is picked. In exceptional cases where the fruit is very uniform this may be feasible.

The ripness of fruit when picked will depend upon varying conditions, the most important point is distance from market. For home use, the berry should be allowed to become fully ripe, as it will then have a better flavor. For local market the fruit should be entirely colored, but showing light at the tip and on the lower side. For distant markets the

fruit should be red on the exposed side and pink or slightly white on the under side or at the tip.

Securing fruit at the right degree of ripeness will necessitate frequent pickings, either daily or at the longest every other day. Hot weather with the consequent rapid ripening will call for daily picking. The fruit should never be picked when wet.



The time allowed to sorting and grading will depend entirely upon the individual grower, or if the fruit is handled through an exchange, upon the exchange. Of course, some sorting and grading is always necessary, if a good, attractive product is desired for the market. A piece of cheesecloth fastened to a frame makes a good sorting table. As a rule one packer can take care of three pickers and do very careful grading.

The following rules for picking and handling strawberries are in force in one of the Western Fruit Exchanges :

(1) Berries must not be picked while there is moisture on the plants.

(2) Berries should be pinked all over, or three-fourths red.

(3) Berries should be picked riper in cool weather than in warm.

(4) A picker must not be allowed to hold more than one or two berries in his hand at the same time.

(5) Filled carriers must not be allowed to stand in the sun.

(6) Berries must be picked with a stem a quarter of an inch long, and not longer or shorter.

(7) Sort out all green, overripe, misshapen and small berries.

(8) No culls in boxes. Put in nothing but fair-sized berries.

(9) Use clean crates and keep from being soiled.

(10) Haul in spring wagon and cover to keep out the dust.

These rules will apply equally as well to any individual grower in New York State.

The fruit is usually packed in quart splint baskets, and these placed in slatted crates holding twenty-four or thirty-six quarts. It is then ready for shipment. For a distant market the crates should be placed on a refrigerator car for shipment. A temperature of about degrees is best for strawberries. Where it is possible, the crates should be placed in a cooling shed as soon as filled and while awaiting transport to local market or shipping station. Strawberries in storage, deteriorate very rapidly, therefore, they should be disposed of as soon as possible.

In most of the strawberry centers of the State, buyers representing commission men from the larger cities are present during the harvesting season. These men will buy the fruit at the local market and relieve the grower of further responsibility. Those growers who prefer may ship their fruit to some commission merchant in the city and let him dispose of it, however, it is generally more satisfactory to dispose of it to the local representative.

In the last few years disposing of the strawberries to canning factories has become more or less important in some districts.

Treatment after Harvest.

The after treatment depends upon whether the grower is going to continue his bed another year or not. The advisability of removing more than one crop depends upon the condition of the bed. Some growers make a practice of obtaining two or even three crops from a bed, others remove one crop, then plow the bed under. If the plants are numerous, vigorous and healthy, and weeds not too thick, they may well be left for a second crop. The berries ripen earlier are slightly smaller and are more apt to be troubled with insects and diseases if left for a second crop. The cost of cleaning out the old bed in many cases is greater than that of setting a new plantation.

If the strawberry vines are plowed under as soon as fruit is harvested, a second quick growing crop may be matured

before winter, or clover may be sown as a cover crop to be plowed under the following spring.

If the bed is to be retained for a second crop, it must be thoroughly renovated. The primary consideration is to develope new growth. A considerable portion of the old foliage will be more or less injured during harvesting, and will also become infested with insects and fungus diseases, hence it is desirable to get rid of the old foliage and allow new to develope. The most economical method is to mow the patch. This can be done with a mowing machine. After mowing the leaves are allowed to dry, also the mulch and litter between rows is stirred up and dried. A windy day is selected and fire started on the windward side of the patch so that it will burn over the patch quickly. Slow burning of leaves and litter over the plans is liable to injure the crowns. If the fire does not run well, the leaves may be raked between the rows and burned.

The next operation in renovating is narrowing the rows. This may be accomplished by running a furrow down through the row or by running twice through the row with a two-horse cultivator. In this way the row may be cut down to any desired width, usually six to twelve inches. This should be followed by harrowing in the direction of planting first, then across the rows. The beds may be gone over several times until the soil is in good condition, using a spike-toothed harrow, with the teeth slanting backwards.

A weeder may be used with fairly good results.

At this time it is a good plan to supply some fertilizer. Well-rotted manure distributed broadcast over the plantation, and harrowed in will give good results. A small application of nitrate of soda (100 pounds per acre) will cause the plants to start growth quickly. The culture from here on is the same as for the first year.

Insect Pests and Plant Diseases.

The strawberry is troubled by a few serious pests and diseases. The worst pest is the white grub, larva of the May beetle or June bug, others are the strawberry-leaf roller, the aphis and weevil. Of the diseases, strawberry leaf blight or spot is the most destructive.

White Grubs are the larva of May beetles or June bugs, having a life cycle covering three years. They are liable to accumulate in old pastures and meadows, and when these are broken and other crops put on the sod, they do considerable injury. The grubs eat off the roots of the strawberry plant.

The eggs are laid in balls of earth in the ground, here they hatch and live until the second summer, eating and destroying the roots of the plants. The larvae change to pupae in the soil and the pupae to beetles in late summer. The beetles emerge the following spring.

Control. Do not follow sod land with strawberries. Put some cultivated crops between.

The Strawberry Weevil injury is done by the adult

beetle cutting off the flower stems early in the spring. The beetles emerge from their winter quarters in early spring. The female deposits her eggs in the bud of the strawberry, then cuts off the flower stem below the bud. In a short time the bud falls to the ground. The grub lives on the pollen and changes to pupae from which the beetle later emerges. If possible, plant mostly pistillate varities, with just enough staminate varities to cross fertilize them, plant early blooming staminate varities as trap crops and spray with lead assenate, place beds in open fields away from hedge rows, etc.

Strawberry Leaf Roller. Moths lay eggs on under side of leaves early in May, these hatch and the young larva feeds upon upper side of leaves for a few days, then folds the two halves over, ties them with silk and lives within fully protected from insecticedes. Moths appear in about a month. Maybe two or three broods per year.

Control. Spray with lead assenate 5 pounds to 100 gallons of water within week after first moths appear and before any leaves are rolled ; burn over the field after the crop is harvested ; plow up old abandoned beds.

Strawberry Leaf Spot or Blight is a fungus attacking the leaves of the plants. First indications are small dark red to purple on the upper surface of the leaves, these spots rapidly spread and enlarge. When firmly established diseased field is very conspicuous because of bright red color which the disease imparts to the leaves. The disease usually attacks

plants after fruit is harvested. It very seldom attacks young plants until leaves are nearly full grown.

Control. Spray thoroughly with Bordeaux mixture 4-4-50, beginning when plants are young and continuing until the berries are ripening ; mow and burn over after harvesting, since the fungus is carried over the winter in these old leaves. Rotate the strawberry bed.

Yields, Cost and Profits.

The yield per acre will vary widely for different localities, and for different growers within a given locality, also there is the climatic factor entering into the question. Dry weather will reduce the yields, wet weather, especially at fruiting, may give a large yield, but this will be reduced by rot in many cases. Different varities will give different yields, etc.

The costs will depend upon the distance from market, transportation facilities, scarcity of labor and various other factors. The following taken from Wilkenson's"Modern Strawberry Growing" will give some idea of what should be expected in strawberry growing.

"Letters from the North, South, West and East show that the average amount of money put into an acre of strawberries is about $100, some returns showing as low as $45 and as high as $150 per acre. The majority of these estimates, however, do not include rental or interest on cost of land.

One of the best worked-out estimates for one acre, valued at $200 is the following :

Interest and taxes	$15
Ploughing, harrowing, etc.	6
Value of 12,000 plants at $6 per M	72
Manure, 50 loads at $1	50
Marking ground and setting plants	8
Summer cultivation	10
Training runners around plants	8
Winter covering and cost of putting on	15
Taking off winter covering	5
Total	$186

The actual cost in money to the farmer for just one acre would be something less than this because, generally speaking the plowing, harrowing, cultivating, setting, training, marketing, etc. can all be done without much, if any lay out of cash by the farmer. Also the cost of winter covering can be greatly reduced, as it would be but a slight expense to raise enough rye oat, or barley straw for this purpose. In fact, the actual cash outlay for the farmer would figure out something like the following :

Taxes	$15
Plants	72
Winter cover(home raised) seed and Fertilizer	8
Total	$85

Added to the above costs in both cases would be the expense of harvesting and marketing :

8,000 quarts at 2¢ for picking	$160
8,000 qt. boxes @ $3.50 per M less 5%	26.60
250 crates, 32 qt. size @ 30¢ per 100 less 5%	71.25
Total	$257.85
Total all costs figured in	443.85
Total farmer's costs	362.85

The returns would, of course, depend largely upon the yield, this may vary from 3000 to 9000 quarts. The fruit will be sold for probably an average of 12¢ per quart retail, or $2 per crate wholesale. Taking the wholesale figure, the returns would be :

8000 qts. (250 crates) ¢ $2	500	500
Minus total costs	443.85	362.85
Net profit	56.15	137.15

The profit per acre will vary, however, as some growers receive even lower than the above, while others will show a profit of $600 on an acre. Below are given the averages from successful Missouri growers, from Mo. Bul. 113.

Cost of Growing.

Plowing and preparing land	$3.24
Plants	13.95
Setting and marking	5.21
Hoeing	12.96
Cultivating	6.99
Mulching material	2.53
Hauling and spreading mulch	5.61
Raking off mulch	.89
Rent	4.75
Cost of growing	$56.29

Cost of Marketing Berries.

Crates	$20.40
Shed hands, bosses, teams work, etc.	9.38

(Cost of marketing berries continued from page 52)

Picking	$26.32
Depreciation on tools	1.80
Cost of marketing	60.97
Total cost of growing and marketing	$118.00

Returns from one year old Bed.

Total income per acre	$135.61
Cost of growing and marketing	118.00
Net income per acre	$ 13.61

Price received per crate varied from 1.12 to 1.90.

Income varied from-$30.98 to+$79.57 per acre.

Cost of care of Bed Second Season.

Items same as for 1st season, but no cost for new plants, plowing, setting, etc.

Total cost of growing	$15.22
" " " marketing	64.49
" " " growing and marketing	$79.81
" income per acre	$148.53
Net income per acre	68.72

From these figures the grower may judge somewhat of the profits to be expected from a strawberry patch.

Fall or Everbearing Strawberry.

Fall bearing strawberries are a rather recent development of the strawberry industry. These varities differ from the ordinary ones in that they blossom continuously from

May until freezing weather sets in. Few fall bearing varities bear their crop the same year that the plants are set out. The first variety of everbearing or fall bearing strawberry of American origin, originated on the farm of Samuel Cooper, of Cattaraugus County, New York. In the autumn of 1898, Mr. Cooper while inspecting his patch came across a plant with runners, laden with blossoms and fruit in all stages of development. This variety was named Pan American -- it is probably a sport or mutation of the Bismark variety.

The chief value of the Pan American lies in its being the parent of better Mr. Cooper has produced two or three better varities, among them, Productive and Superb.

Besides Mr. Cooper, several others are working on fall bearing varities with more or less success. Among them being Louis Hubach of Arkansas ; L. J. Fainer, Pulaski, N. Y. and Harlow Rockhill of Iowa. The latter has been most successful, having produced a number of seedlings. Probably his best two are seedlings Nos. 1 and 2, now named Francis and Americus.

Treatment of Fallbearing Strawberry.

General cultural methods are the same as for spring varities. These fall bearing plants are set out in the spring if a crop is desired the same year. By the last of May or the first of June they will blossom. These blossoms should be removed. For the next three or four weeks the plants will devote their energies to the production of runners, then they will begin blossoming again, and continue to do so

until freezing weather sets in. The blossoms should be removed until three weeks before plants are desired to fruit, usually until about August 1st. From then on, the blossoms may be left and fruit harvested from the latter part of August until November freeze up.

Picking should be made two or three times per week at first, as the weather grows colder the amount of fruit produced will decrease.

ONE DAYS PICKING OF FALL BEARING STRAWBERRIES

The cost of producing fall strawberries is considerably greater than for spring, consequently they must be sold for a correspondingly higher price. It is safe to expect at least 25¢ per quart under present conditions, and will hardly pay to raise them for less.

The market for fall berries is more or less restricted since few are produced, but growers should find little difficulty in disposing of their crop to hotels in nearby

cities or to a selected group of customers.

The future of fall or everbearing strawberries is rather doubtful since they will have to compete with many different fruits, such as plums, pears, apples, and peaches, which competition, the early to a large extent escape.

Bibliography.

Bailey, L. H.

1906 Evolution of Our Native Fruits.
1904 Cyclppedia of American Horticulture.

Chandler, W. H.

1913 Commercial Fertilizers for Strawberries. Univ. of Mo. Agr. Exp. Sta. Bul. 113.

Close, C. P. et al

1907 Strawberries. Md. Agr. Exp. Sta. Bul. 124.

Fuller, Andrew S.

1910 The Small Fruit Culturist.

Green, W. J. et al

1912 Strawberry Notes. Ohio Agr. Exp. Sta. Bul. 236.

Moore, J. H.

1915 Strawberry Culture in Wisconsin. Univ. of Wis. Agr. Exp. Sta. Bul. 248.

Shaw, G. W.

1900 Miscellaneous Investigations. Ore. Agr. Exp. Sta. Bul. 62.

Taylor, O. M.

1908 Variety Test of Strawberries and Cultural Directions. N. Y. (Geneva) Agr. Exp. Sta. Bul. 309, 336, 364, 401.

Wilkinson, Albert

1913 Modern Strawberry Growing.