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STRAWBERRY CULTURE IN MISSOURI

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Fig. 1.—A near view of strawberry plants just before the fruit begins to ripen.

The strawberry is more widely grown than any other kind of fruit. Wherever diversified agriculture is practiced, strawberries may be grown profitably. For more than six months each year strawberries may be found upon the principal markets of the country. The strawberry is the most valuable of the small fruits grown in Missouri.

Every community in Missouri can use locally the product of from one to ten acres of strawberries. This fruit is not grown as generally in the home vegetable garden as it should be. Comparatively few counties in the State furnish berries for the local markets and shipments also for markets outside the

State. In most communities, therefore, there is an opportunity for some good grower to supply berries for local demand at remunerative prices.

According to the United States Department of Agriculture, the average yield of strawberries for the whole country is about 1,800 quarts per acre, valued at $150 to $200. The commerical yield in Southwest Missouri in 1923 was 800 cars. The Federal and State Crop Reporting Service reports the following for the State in 1923: Strawberries 10,560 acres, 41⅔ crates per acre, 440,000 crates (1,000 carloads), $3.15 per crate; total value $1,386,000. There is probably no crop that will produce more dollars per acre than the strawberry; however, no one should attempt to get rich quick by planting too large an acreage the first year. In such a case failure would be almost certain.

Fig. 2.—A 40-acre strawberry field in the Ozark Region of Southwest Missouri.

The strawberry is an especially good crop for the home garden. It is adapted to a wide variety of soils, and is comparatively free from injurious insect pests and plant diseases. The plants rarely require spraying. The crop is suited to the garden rotation, may be planted at a small initial cost, and will bring quick returns and large yields.

The record of strawberry production compares very favorably with the production of other crops; yet, on the acreage of strawberries now under cultivation in Missouri, the yield could be doubled with increased profits by putting into practice better cultural methods. It is important that the acre yield be increased and the cost of production decreased.

SOILS AND LOCATION

The strawberry has a wide range of adaptation to various conditions of soil and climate. It is a well known fact that with proper care and attention this fruit will thrive upon any soil suited to the production of farm crops. In many instances growers maintain that on poor soils they secure larger yields

from strawberries than they do from grain crops. In general, most varieties do better on light, sandy, gravelly or stony soils than on clay, heavy or wet soils. New land is often preferred because of the increased yields and because there are fewer weeds to fight and less cultivation required. For best results, a well drained, fairly light, moisture holding, medium fertile soil is generally desired.

Soil and location will influence to some extent the time of harvest and the earliness of spring growth. For instance, a light, sandy or stony soil with a southern exposure will produce earlier fruit than a heavy, moist soil with a northern exposure. Also, low lands with poor air drainage are not as satisfactory as higher ground with good air drainage for strawberry production, because poor air drainage increases the liability of the plants to frost injury.

IMPROVING THE SOIL

Strawberries require large quantities of soil moisture in maturing a crop. By plowing under barnyard manure and such leguminous crops as cowpeas, soybeans, clover or alfalfa, humus and nitrogen are added to the soil. Non-leguminous crops like wheat and rye may also be plowed under for the purpose of building up the water-holding capacity and humus content of the soil. In most cases, it is perhaps more important to loosen and aerate the soil and increase its water holding capacity than it is to add fertility in the form of nitrogen.

On account of the danger of injury from the white grub, clover, timothy, bluegrass and other sod lands should be planted to truck or grain crops for a year or two before setting strawberries.

SELECTION OF VARIETIES

There are many varieties which are cosmopolitan and may be grown successfully over a wide area. Other varieties are restricted to certain sections or localities. Of the 1,800 or more varieties of strawberries, relatively few of these are adapted to any one combination of soil, climate, methods of growing or marketing conditions.

In the strawberry growing districts of South Missouri the leading commercial varieties in the order of their ripening are as follows: Klondike, Aroma and Gandy; while in North Missouri the main varieties are: Dunlap, Warfield and some of the earlier sorts. The two principal commercial varieties of the State are Aroma and Dunlap, the Aroma succeeding best in the south and the Dunlap in the north. Warfield is well adapted to all parts of the State, and such sorts as Mitchell, Clyde, Bubach, Sample and Gandy are favorites for table use. The Progressive and Superb are the leading everbearing varieties.

When the strawberry is desired from spring until fall, the grower may plant an extra early variety, a mid-season sort and an everbearing variety. The very early varieties will supply a moderate crop, the mid-season sorts the main crop, and the everbearing varieties fresh fruit for table use during late summer and early fall. For best results, the grower should limit his planting to a few varieties.

Some varieties, like Sample, are called pistillate or imperfect varieties because of the plant's failure to produce the pollen necessary for fertilization, and they produce little or no fruit when planted alone. This difficulty may be overcome by planting every fourth or fifth row to a staminate or perfect variety such as Dunlap.

A partial list of standard varieties is given below, with the season of ripening. Some of these varieties should do well in all parts of the State. The letter (S) indicates a staminate or perfect variety and (P) a pistillate or imperfect sort. The leading commercial varieties are printed in **boldface** type.

EARLY	MID-SEASON	LATE
Mitchell (S)	Haverland (P)	**Gandy (S)**
Excelsior (S)	**Dunlap (S)**	
	Bubach (S)	
MEDIUM EARLY	MEDIUM LATE	EVERBEARING
Clyde (S)	Sample (P)	Progressive (P)
Warfield (P)	Klondike (S)	Superb (P)
	Aroma (S)	

Fig. 3.—An excellent strawberry field just before harvest, Columbia, Missouri.

DESCRIPTION OF VARIETIES

Aroma is the leading commercial variety of the Ozark region, including Southwest Missouri, northwestern Arkansas and southeastern Kansas. It is valued highly because of its uniformly large size and its productiveness. The Aroma is disease-resistant, a good shipper and very attractive. It ripens from midseason to late.

Dunlap is the most widely grown variety in Central and North Missouri. It is a good plant producer and the fruit is high in quality and attractive. Dunlap is one of the best pollinizers for pistillate sorts, as it blooms heavily from early until late with its greatest production occurring in mid-season.

It thrives better under neglect than most other sorts. It is not firm enough for distant shipments, but is a good variety for canning.

Warfield is well adapted to all parts of the State. It is a handsome berry, an excellent shipper, a good cropper and withstands frost better than most varieties. Warfield is an imperfect variety and is usually pollinated by Excelsior for early and Dunlap for late berries. It is one of the best berries for canning. It does not thrive as well as Aroma and Dunlap during hot weather or during periods when moisture is lacking.

Gandy is the standard late variety. It has certain soil requirements and for the greatest returns does best on a rich soil with a clay subsoil and an abundant supply of moisture. It is also an excellent shipper. Although a staminate variety, it produces very little viable pollen and for best results should be planted with some strongly staminate variety such as Dunlap or Aroma.

Haverland is one of the best varieties for family use. It has a long ripening season and is seldom injured seriously by frosts. The main crop is produced in mid-season. It is very productive, but the berries are too soft for shipment to distant markets. Haverland is an imperfect variety and Dunlap is usually grown with it as a pollinizer.

Bubach is a valuable variety for home use and nearby markets. It is an imperfect variety and is usually pollinated with Clyde or Aroma. When properly pollinated, Bubach is one of the heaviest yielding sorts.

"EVERBEARING" STRAWBERRIES

Of the everbearing varieties, the most popular in the state are Progressive and Superb. These varieties are more widely grown than any other sorts of their class. Investigations at this Station made under irrigation conditions and under the normal rainfall conditions have shown that the everbearing varieties are not as profitable as the spring bearing sorts. Everbearing varieties may be successfully grown, however, in the garden for home and local use. Where rainfall and markets are favorable, they may also be grown with profit on a commercial scale.

PREPARATION OF SOIL

For planting in the spring, it is generally best to plow the ground during the fall or winter where conditions will permit. By so doing, the grower is usually able to prepare the field for planting earlier in the spring. A firmer and more compact soil results from fall or winter plowing. This is an advantage to the strawberry plant because such soil preparation usually makes available a more constant water supply to the roots.

If the ground is plowed in the fall or winter, it is generally best to postpone harrowing or disking until early in the spring. With some soils several diskings or harrowings may be necessary to put the soil in the proper condition for planting. It is important that the surface soil be stirred sufficiently to make the ground loose and friable. Rolling or otherwise packing the soil is desirable on newly prepared land, as it aids in judging the correct depth to set the plants.

TIME OF PLANTING

Early spring planting is generally preferable to late summer or fall planting. Spring-set plants, excepting everbearing varieties, do not bear fruit until

the following year. Plants set in the fall and grown under favorable conditions will bear a fair crop the following spring. For spring setting, the planting should be done as soon as the soil can be worked; while the latter part of August or September is usually best for fall planting.

The best results are generally secured by purchasing the plants from some reliable nurseryman who makes a speciality of growing good plants. Many growers are in the habit of procuring plants for setting from the old strawberry beds or fields, and if good judgment and care are used, satisfactory plants may be obtained in this way.

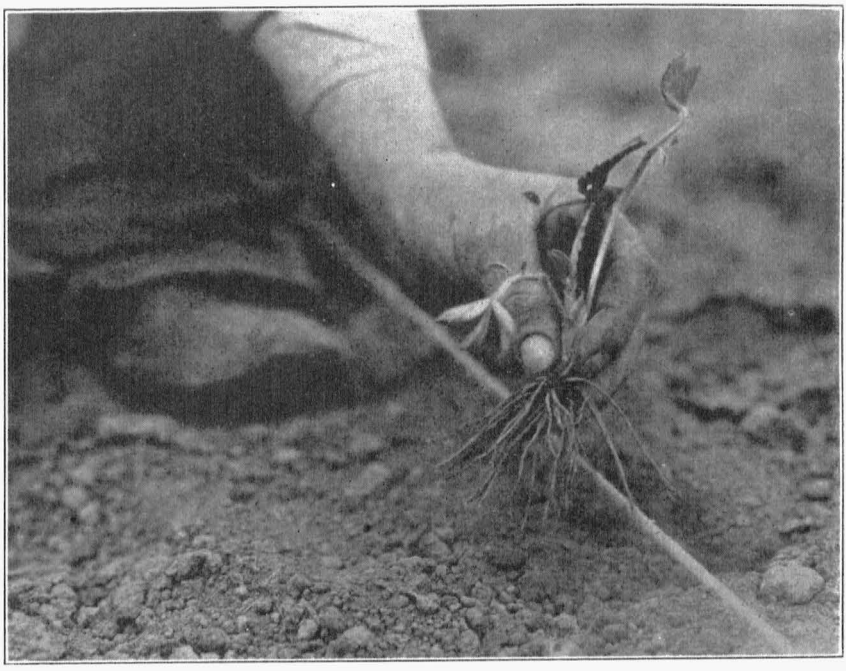

Fig. 4.—A strawberry plant with top and root system properly pruned for setting.

SELECTING THE PLANTS

The best growers agree that it is highly important to plant large, sturdy, vigorous, one-year-old plants. Generally not enough thought and attention are given to the matter of securing the best plants. The large plants usually stand transplanting better and start forming runners or new plants more quickly than small ones.

PLANTING SYSTEMS

The commercial growers generally prefer the matted row system of training. It is the simplest and easiest to establish and maintain. The runners are allowed to set at random in a row 18 to 20 inches wide. Some growers train the runners and space the plants while hoeing, but this is not required. The

plow breaks off the runners and drags them lengthwise, which will prevent the middles between the rows from filling with plants. If the runners are weighted lightly with soil, they will root more quickly.

PRUNING BEFORE TRANSPLANTING

Strawberry plants will generally give better results if they are pruned before planting. Part of the leaves are removed to reduce transpiration before the roots become established in the soil. The amount of pruning will depend upon the season of the year, the size of the plants, and the condition of the weather and soil. Early in the spring when the leaves are small and few in number, little pruning is required. When the plants are older and the time of planting later, all but one or two of the smallest leaves in the center should be removed by cutting the stems near the crown of the plant. There is always more danger of cutting off too few leaves than of cutting too many. The roots are usually cut back from one-fourth to one-fifth of their length, leaving them about 4 or 5 inches long. The removal of a portion of the root system will permit better spreading of the roots and facilitate transplanting.

HOW TO SET STRAWBERRIES

It is important that strawberry plants be transplanted to the proper depth. An opening in the prepared soil should be made just deep and wide enough to accommodate the roots when spread slightly and to allow the crown of the plant to be level with the ground when the soil has been thoroughly firmed about the roots. The opening in the soil may be made with a dibble or other implement suitable for the purpose. If the crown of the plant is covered with the soil, the plant will usually die or make a slow growth. If the crown extends too far above the surface of the ground, the plant may dry out and die or it may become unprofitable.

When the soil has been well prepared, the land may be laid off in rows by means of a plow equipped with a rather long, narrow, shovel. The furrows may be crossed with a marker to indicate the planting distance in the row. The ground is sometimes checked with furrows running in trans-verse directions and the plants are placed at the point where the furrows cross. Other methods also are employed in checking and marking off the land for planting. The most important points to remember in transplanting strawberries are to thoroughly firm and compact the soil around the roots of the plants and when the work is finished to have the crown or growing point of the plant just level with the top soil.

RENEWING THE STRAWBERRY FIELD

The renewal of a strawberry field after harvest involves the following operations: first, the renewing of the tops of the plants by mowing or burning; and second, the reduction of the number of plants by plowing and hoeing. Following the renewal of the strawberry field, frequent shallow cultivations should be given during the remainder of the growing season.

Strawberry fields and beds are generally renewed after the first crop. In some cases it may be profitable to renew after the second and third crops. In so doing, the fields or beds are fruited two or three years. It is not usually profitable, however, to renew the crop more than once, but strawberries may again follow in a rotation after vegetable and farm crops. Only well cared

for fields are worth renewing. Where the old patch has become weedy and grassy it may cost more to renew it than to plant a new field, which is usually more profitable.

The purpose of renewal is to thin out the older and less productive plants in the rows and to give those that remain an opportunity to make vigorous, healthy, new plants. The amount of thinning will depend upon the fertility of the soil, season, stand, vigor and thriftiness of the plants, and the ability of the variety to produce new plants. In old fields where the stand is poor and the conditions unfavorable for plant making, few if any plants should be removed. Where the conditions are good for the growth and multiplication of the plants, they may be thinned with a hoe or plow to a distance of 8 to 12 inches. It is important to leave the plants closer together than originally set, because they will not make as many runners and plants, as a rule, as they did the first year.

The strawberry field should usually be mowed and raked immediately after the harvesting period. These operations will rid the patch of injured leaves, and assist in the control of fungous diseases and insect pests. A mowing machine with the cutter bar tilted slightly in front may be used effectively for this purpose. After mowing, the leaves and mulch may be raked into windrows and removed from the field.

Instead of mowing and raking, the practice of burning the field is sometimes recommended. There is danger, however, of the fire doing injury to the crowns of the plants if the mulch material is rather heavy and the fire does not move over the field rapidly. The leaves and mulch are also sometimes raked to the middles between the rows and burned

The next operation after removing the leaves and mulch is to narrow down the old matted row. This may be accomplished in a number of ways. One of the most common is to plow a furrow down either side of the row, throwing the soil away from the row. The same results may also be secured by running twice between the rows with a two-horse cultivator. In this way the old strawberry row is reduced to the desired width, which is usually from 8 to 12 inches.

Another method of narrowing down the width of the old matted strawberry rows has been successfully used on the grounds of the Missouri Agricultural Experiment Station. It consists of plowing on both sides of the row, throwing the soil toward the center. This covers the weak plants near the ends of the runners, and leaves the strongest ones near the parent plants.

After the width of the strawberry row has been reduced the soil is leveled and cultivated with the harrow. The harrow is operated in the rows and across the rows, thus pulverizing and spreading the soil around the plants. Some of the crowns of the plants may be slightly bruised and injured as a result of the cultivation across the rows; but this injury is seldom if ever severe enough to overbalance the beneficial effects of the cultivation and of the fresh, loose soil placed around the crowns of the plants. The hoe may be used after plowing, leveling and pulverizing the soil, to accomplish additional thinning if needed, and to remove old crowns and weeds.

Usually better results will be secured if renewed fields are fertilized. A small application of nitrate of soda, 100 pounds per acre, and 250 pounds of acid phosphate may be applied to the rows. After renewal, frequent and thorough cultivation should be given until growth ceases in the fall.

CULTIVATION

Perhaps there is no more important factor in strawberry production than thorough and frequent stirring of the soil to make available plant food and to assist in the conservation of moisture. This applies to both the new and old fields. For best results as many as 12 or 15 plowings and hoeings may be required, although few strawberry fields receive this much care. In other words, the plants should be cultivated at intervals of ten days or two weeks from the time they are set until vegetation is killed by the frost in the fall. The number of plowings and hoeings will depend a great deal upon the amount of rainfall. It is very important that the ground be stirred as soon after each rain as it will do to work. If the interval between rains is four or five weeks, shallow cultivation should generally be practiced between rains.

Fruit production is a great drain on the plant. For this reason, all blossom stems should be pinched off during the first year in order to produce many strong, vigorous, young plants. The removal of the blossoms by pinching may be accomplished at the periods of plowing and hoeing.

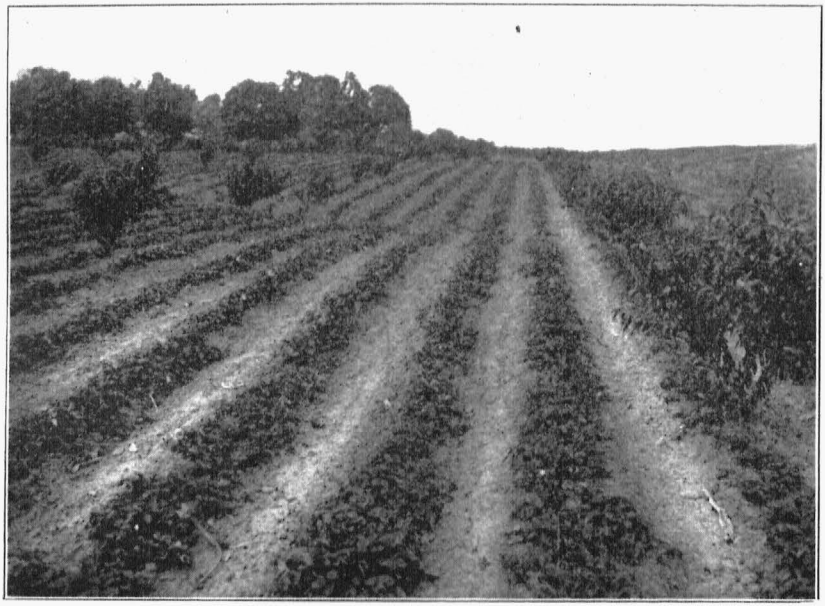

Fig. 5.—Strawberries as a catch crop in a young peach orchard near Pierce City, Missouri.

INTERCROPPING WITH STRAWBERRIES

The young orchard can be profitably intercropped with strawberries until it comes into bearing. If the strawberries are properly managed and cared for they will bring in a good return from the land until the trees bear paying crops of fruit. The strawberries should not be planted too close to the trees, however, because the crop may remain in the soil two or three years. It is important that they be planted well outside the limit of the root growth.

Since the roots of the trees extend beyond the horizontal spreading of the branches in the tree top, the strawberries should be planted at least three or four feet beyond the spread of the limbs. This would allow the first row of strawberries to be planted on either side of the tree row at a distance of 6 to 8 feet from the row. If this plan is adopted, the strawberries will do the trees no harm and the cultivation and fertilization given should greatly benefit the orchard.

FERTILIZATION

Where the soil fertility has been kept up by the rotation of crops, the growing and plowing under of leguminous or non-leguminous crops and barnyard manure, it is usually unnecessary to use commercial fertilizers. Their use in many cases might actually be a detriment rather than a benefit to the crop. This would be particularly true if too much vegetative growth occurs. The fruit is made much softer, and poorer in color by heavy fertilization. It is also less desirable for shipping purposes. Where the soil will grow good crops of corn or wheat, usually a profitable crop of strawberries can be produced without fertilization.

Experimental work at the Agricultural Experiment Station at Columbia and in the Ozark Region indicates that acid phosphate at the rate of about 250 pounds per acre, is more often needed as a fertilizer than potash or nitrogen. If a phosphate fertilizer is used, it may be spread broadcast along the rows about ten days or two weeks after the plants are set, and worked in with hoe and cultivator; or it may be spread in the rows at planting time. Acid phosphate applied either the current year or the previous year has given marked increases in yield, while nitrate of soda and dried blood have given, in general, negative results, and in some cases caused a decrease in yield.

MULCHING

Under most conditions mulching is a profitable practice in Missouri. Nevertheless, many of the Ozark strawberry producers procure profitable yields from their fields without mulching. This is particularly true where the surface of the soil is covered with stones, chert or flint rock, and there is only a small amount of soil near the surface. The stones appear to have an effect upon the soil similar to that of a straw mulch.

The mulch should generally be spread in the fall or early winter after the first hard freeze. A mulch from 2 to 4 inches in depth will conserve moisture, tend to prevent heaving of the soil and keep the ripe fruit clean at harvest time. The best material for this purpose is wheat straw. Rye straw, hay and leaves are frequently used, but these are generally not as satisfactory. The mulch should be raked lightly from the center of the rows toward the middle between the rows early in the spring just before growth starts. If the mulch is left on the rows too late, the time of ripening may be delayed for a week or more. In locations subject to frost, the mulch may be used to delay the blossoming period.

HARVESTING AND MARKETING

The harvesting period for the Ozark region generally commences during the latter part of May and lasts three or four weeks. In Central and North Missouri the harvest is from a week to ten days later and the period is slightly

shorter than that of the Ozark region. In some communities, local help is relied upon for picking, but in a great many districts it is necessary to import pickers. When the pickers are brought in, camping grounds, water, tents and other facilities are often furnished. The best growers have learned that it pays to employ the best and most reliable help and to procure the same pickers year after year if possible. To do this, it is necessary to exercise the best judgment in the care and handling of the pickers.

Fig. 6.—Stony land in the Ozark Region of Southwest Missouri planted to peaches and strawberries.

In order that the berries may be pre-cooled properly and reach the market in good condition, the picking should be done when the fruit is cool and dry and in just the right condition of maturity. When the weather is warm it may be necessary to pick over the field every day. Early in the season and during cool weather picking every other day may be all that is required. The morning hours are usually best for picking, because the berries are subjected to less injury by the hot sun. The fruit ships better if picked when cool and firm, and the pickers can do more and better work during the cooler part of the day. The only objection to picking during the morning hours is that the berries may be wet with dew. Since the berries go down faster when picked wet, they should be picked dry if possible. It is also important that the fruit be carefully and honestly graded according to the rules of the association and removed to the refrigerator car or cold storage without delay.

To make marketing a success, standard varieties must be grown, adequate shipping facilities must be maintained, and an efficient marketing organization is essential. The acreage near the shipping point should be sufficient to load

at least one car daily. This will require from 75 to 100 acres which should be located within a radius of not more than three or four miles from the shipping point.

INSECTS AND DISEASES

In many parts of the State strawberries may be grown successfully without a great deal of trouble from the attack of insect pests and fungous diseases. This will be particularly true where the strawberry field is rotated with field crops and where strong, healthy, vigorous plants are used for the setting of the field.

The strawberry leaf spot, a fungous disease which seriously affects some varieties, and the strawberry leaf roller, an insect, may affect the plants badly enough to justify spraying with bordeaux to destroy the fungus and with arsenate of lead to kill the insect. Where spraying is necessary, the first application should be made shortly after growth is started in the spring, using 4-4-50 bordeaux and 1 pound of arsenate of lead. The second application should be made about ten days or two weeks later. If the infestation is serious, a third application may be needed just before the plants begin to bloom.

The white grub is frequently a pest of strawberries. The grub feeds upon the roots and crowns of the plants. It may usually be prevented by planting sod land to truck or grain crops for a year or two before setting strawberries.

The crown borer, root louse and other insect pests are sometimes troublesome. These and all the other insects and fungous diseases injurious to the strawberry may usually be controlled by the proper rotation of crops, good culture and by maintaining old fields no longer than two years.