GROWING SATSUMA ORANGES IN SOUTH MISSISSIPPI

Satsuma tree four years old, Pearl River Highlands Company, Carriere, Mississippi

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
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Growing Satsuma Oranges in South Mississippi

By

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In the following pages we shall endeavor to discuss very briefly some of the things which should receive primary consideration in establishing and managing a commercial satsuma orange grove in South Mississippi. Attention will be given to location and site for the grove; land preparation; selection of varieties, and trees; setting trees; pruning; cultivation; fertilization; intercropping; pest control; winter protection; and harvesting.

SELECTION OF A LOCALITY FOR A GROVE

In determining whether a locality is suited to commercial satsuma orange culture, it is important to study first the climate of the section, and then ascertain if the soil is the right kind. Climatic considerations still easily lead as the limiting factor in any citrus fruit culture. Since the inception of the use of Poncirus trifoliata as a stock for satsuma oranges, the potential citrus producing belt of this country has widened fifty to seventy-five miles further north, yet the prospective grower should have accurate information of the territory before deciding to set satsuma orange trees extensively. In cooperation with the Weather Bureau of the U. S. Department of Agriculture, our station has kept since 1903 a daily record of maximum and minimum temperatures and rainfall. This record was kept at McNeil until the removal of the station to Poplarville in 1919. Studying this weather record rather carefully one will note that December, January, and February represents the coldest months of the year in this section. Looking further at these records, we find that the lowest minimum temperature recorded in December during this period of 25 years was 14° F. and that only once. In January the lowest recorded was 12° and that only once; while we notice in February the lowest recorded was 13° and that occurred only once during the period. The average of all the lowest temperatures in the month of January was 22°, that for February was 25° and for December, 25°. As to the rainfall of this section the record shows that there is ample rainfall in every year to take care of the needs
of satsuma orange trees under any ordinary conditions. Our observations have been that where planted on the proper site and when given good care this tree will withstand temperatures as low as 15° without wood injury. In the plantings at this station 16° above zero has defoliated trees but has never injured the branches.

Besides climatic considerations there is to be considered by the prospective satsuma orange grower the ease with which the crop can be gotten to market. Such matters as distance from central packing houses or from railroad and the ability of the railroad serving the territory to haul perishables satisfactorily to northern and eastern market centers, should receive attention. Also, the new settler should find out how satisfactory are the schools, churches, roads, and other organizations which help to make the farm home life more desirable.

Satsuma orange groves are planted at present on "pine lands," "flat woods lands" and "high or low hammock lands." According to the Soil Surveys of the U. S. Department of Agriculture, the soils best adapted are Greenville and Norfolk Sandy Loams. We would say that the soil best suited to the growth of this fruit is a fine sandy loam with a clay subsoil, well drained, and of good natural fertility. One should avoid planting on low, damp soils and those having very sandy subsoils.

A site selected for the satsuma orange should be one which has as perfect air drainage as possible. The grower should also see that the composition of the soil is not too light and that the slope towards the south is moderate. This slope is not to be over one inch per foot if there is high land across the valley, because the wind will disperse the cold air from the surface of the ground on the northern part of the slope, but will not do so on the southern part. The importance of this is increased if a stream is on the south edge of the slope. It should be kept in mind that it is the cold, damp, air that settles over the surface of the ground which damages trees rather than cold wind blowing through the orchard.

**PREPARATION OF LAND FOR PLANTING**

After one has decided to plant an orchard of satsuma oranges in a locality and has selected a desirable site for the orchard, it then becomes important to prepare the land for planting. All stumps should of course be removed first. Bulletin 159 of the Mississippi Experiment Station describes several good
methods of clearing pine lands of South Mississippi. Burning is practiced more in the clearing of pine stumps than any other method. If possible to do so, the grower should plow the land broadcast, disk and harrow it and grow a crop on it one year before setting out the trees. A crop of soy beans or cowpeas can easily be grown the first year to put the land in good cultivation.

The amount of rainfall in South Mississippi and the texture of some of the soils make it important to give attention to the amount of slope. It is the opinion of the leading agricultural engineers that when land in South Mississippi has a vertical fall of $1\frac{1}{2}$ to 3 feet each 100 feet horizontal distance, depending upon type of soil, it should by all means be terraced. When land is terraced, it has seemed to be more desirable to plant the trees on the contours of the slope and cultivate with the contours. Copeland (9) says this about planting orchards where land is terraced: "In orchard planting it is generally recommended that trees should be set just under the terrace ridge but on the terrace. Secondary rows are then set between the terrace and parallel to the terrace above—in cultivation these lines become secondary terraces which further protect against soil erosion." Before laying out a hilly orchard every grower should request from Mississippi Extension Division, A. & M. College, Mississippi, a complete list of blueprints on terraces. These show in detail how the work is done. Of course, if the grove is to be planted on plateau land, or land that is not liable to erode from cultivation in both directions, the trees should be planted in straight lines. This adds to the beauty of the grove as well as makes it easier to handle cultivating implements, spraying machinery, and harvesting wagons.

**SELECTION OF VARIETIES AND TREES**

*Owari* is the only variety of satsuma orange recommended for planting for commercial purposes. This variety is earlier and has better quality than *Ikeda* which is sometimes planted. The prospective grower should be sure that trees bought are worked on stocks of the trifoliate orange, *Poncirus trifoliata*, as this is the only stock recommended for use under South Mississippi conditions. Nurserymen in the section are aware of this, however, and little trouble should be experienced in the matter of getting the right stock. Results seem to show that year-old buds, that were worked on one and two-year-old stocks, make the best and cheapest trees to set out.
SETTING TREES

When planting in straight lines any one of the systems illustrated on the following pages may be employed that suits the growers. Figure 1 illustrates the triangle system. The rectangular or square system is shown in Figure 2. This is by far the simplest of all planting systems and is used more than the others. Figure 3 illustrates the hexagonal system. This system is the only one in which each tree is equidistant from each of its neighbors, and the only one that equally divides the space. About 15% more trees can be set to the acre than by the square system. Figure 4 illustrates the quincunx system of planting. By this system about 78 per cent more trees can be set per acre than by the square system. Table No. 1 shows the approximate number of trees to plant an acre by the different planting systems and for different distances.

For the best lands of the Coastal section, it is usually considered best to plant satsuma orange trees at least 20 feet apart in each direction. Some even advise 20 by 25 feet. If planting is done along the northern border of the satsuma belt where there is more likelihood of injury from cold, it is usually conceded best to plant more trees per acre and some even plant as close as 15 by 15 feet.
TABLE No. 1
APPROXIMATE NUMBER OF TREES TO THE ACRE FOR DIFFERENT PLANTING SYSTEMS

<table>
<thead>
<tr>
<th>Distance apart</th>
<th>Triangular</th>
<th>Rectangular (square)</th>
<th>HexagnoI</th>
<th>Quincunx</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 by 15 feet</td>
<td>175</td>
<td>193</td>
<td>217</td>
<td>247</td>
</tr>
<tr>
<td>20 by 15 feet</td>
<td>132</td>
<td>145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 by 18 feet</td>
<td>122</td>
<td>134</td>
<td>142</td>
<td>247</td>
</tr>
<tr>
<td>20 by 20 feet</td>
<td>98</td>
<td>108</td>
<td>124</td>
<td>199</td>
</tr>
<tr>
<td>25 by 20 feet</td>
<td>79</td>
<td>87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 by 25 feet</td>
<td>64</td>
<td>70</td>
<td>81</td>
<td>126</td>
</tr>
</tbody>
</table>

Before setting out trees, the orchard should be laid out carefully and as accurately as possible, using any convenient means to establish each tree position. A stake should be driven where each tree is to be set. In digging the holes and in placing the trees it will be found very advantageous to use a "planting board." This simple contrivance is illustrated in the drawing below:

Fig. 5. "Planting board," consisting of a board 1x6 inches and 4 feet long, with a notch cut in one edge near the middle and in each end.

Fig. 1, triangular system

Fig. 2, rectangular system
Fig. 3, hexagonal system

Fig. 4, quincunx system

Satsuma Grove being cultivated with good equipment including Fordson tractor and disc harrow.
To use the planting board, it is necessary only to place it flat on the ground across the tree row so that the center notch fits over the tree stake, place a small stake in each end notch, remove board and dig hole about tree stake. When placing tree for setting, put board back into the same position and set tree trunk in center notch. The tree will then be properly lined with the others. If planting is done in extreme dry weather, a pail of water should be poured into each hole before the dirt is filled in around the roots. It is usually recommended that tree be set in the latter part of the dormant period, which is in February, while they may be set any time during the winter months.

PRUNING

Very little pruning is considered necessary for Satsuma orange trees and indeed little is actually done in groves now established. It is more desirable to have the trees form low heads. Dead growth and undesirable branches should be kept cut out as the tree develops, and long, weak limbs should be headed back so as to keep the trees compact and symmetrical. Of course, each tree should have a framework of three or four main branches. In case of freeze injury cut back all dead branches, as soon as the extent of the damage can be determined.
CULTIVATION, FERTILIZERS, COVER CROPS AND INTERCROPPING

In South Mississippi the satsuma orange grove should be kept in good tilth throughout the growing season. Nearly all of our soils can be greatly improved by the growth of leguminous cover crops in the orchards, and it is therefore advised that frequent shallow tillage be practiced from March until a summer cover crop of cowpeas or soybeans is planted in June. Such handling of the groves will so harden the trees that they will be much more able to stand freezes. This crop may be cut into the land with a disk in the fall and a crop of Austrian Winter peas can be sown for growth during the winter. Several species of Crotalaria are being tested as summer cover crops also, and some of them may prove quite satisfactory. *C. spectabilis* and *C. striata* are two of the most promising kinds at present. The former was formerly called *C. sericea*. When land for cultivated field crops is scarce it is permissible to practice intercropping but advisable to grow only such low-growing crops as the several adapted truck crops. The only advantage of intercropping is the possibility of income from the land before the trees reach bearing age. The trees should never be allowed to suffer from crops grown between them.

For economical production South Mississippi seems dependent upon applications of commercial fertilizers to all crops. Satsuma oranges are not an exception in this respect. This station has been doing no fertilizer testing with this fruit, but has been getting very satisfactory results from an 8-4-4 analysis applied in March and two pounds of sulphate of potash applied per tree August 1. On pre-bearing-age trees we would recommend the use of 3 to 6 pounds of the above analysis for the spring application, followed by an early fall application of potash. Amounts per tree should depend upon the natural fertility of the soil and whether legumes are grown as cover crops, and it should be increased by at least one pound per year. For bearing trees we would advise 5 to 12 pounds per tree, depending upon the size and age of trees as well as natural fertility and amount of leguminous cover crops grown, to be applied about the time growth starts in the spring, followed by the early fall application of some form of potash, in amounts ranging upward from 2 pounds per tree of sulphate, depending upon size of crop on the trees.
PEST CONTROL

Chief among the pests that the grower of satsuma oranges will find it necessary to combat are scab, scale insects, white-fly, rust mites, and red spiders. Much of the information now in print about the control measures for these pests is being debated. However, we have summarized the suggestions made by the leading entomologists and pathologists of the section and after checking this against the results obtained by the most successful growers of the satsuma orange belt, have made up a spray calendar for use as a guide in controlling these pests. This calendar is shown in Table 2.

**TABLE No. 2—SPRAY CALENDAR.**

<table>
<thead>
<tr>
<th>Time</th>
<th>First spraying</th>
<th>Second spraying</th>
<th>Third spraying</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Just before growth starts in spring</td>
<td>When ¾ blossom petals have fallen</td>
<td>June or July, when insects appear</td>
</tr>
<tr>
<td>Time</td>
<td>Bordeau mixture 3-3-50 plus ¾ to one gal. oil emulsion</td>
<td>Bordeau mixture 3-3-50 plus 3 pints oil emulsion (Spreader)</td>
<td>Sulphur dust or conc. lime-sulphur 1-70</td>
</tr>
<tr>
<td>Pests</td>
<td>Scab, scale insects, white flies.</td>
<td>Scab</td>
<td>Rust mite and red spider.</td>
</tr>
</tbody>
</table>

**NOTE:** The third spraying may need to be repeated. The number of applications can be determined by the grower’s observation. If the red spider is very bad it will be necessary to make an application of concentrated lime-sulphur during the winter, at a strength of 1 to 50. If the temperature is above 85° F. dusting could be done satisfactorily. If scale and white-flies are bad, an early dormant spray of oil emulsion, at a strength of one gallon to fifty gallons of water, might well be applied, but be sure this is done four to six weeks before any cold weather comes. Trees thus treated do not suffer from cold as do those sprayed with oil immediately before occurrence of low temperature.

The grower of satsuma oranges will very often find it necessary to provide some means of protecting trees while young against injury by rabbits. In a great many cases these animals have so girdled the trees by gnawing the bark that many trees were killed entirely. The simplest method used for protecting trees has been to wrap loosely around the base of the trunk to a height of 12 to 18 inches old newspapers or maga-
zines. A more permanent contrivance can be prepared by cutting strips of screen wire wide enough to make a miniature cage around the tree trunk to the desired height. Such cages can be placed on the tree or removed when necessary and stored away for future use. Whenever such protective measures are used they should be taken away when banking and should never be wrapped tightly around the tree.

WINTER PROTECTION

Of primary importance in protecting satsuma orange orchards from winter injury is having the orchard on the proper site. Elevation being sufficient, and there being freedom from obstructions on all sides, affording perfect air drainage, there is left only soil drainage to be looked after. Be sure the soil has drainage even if tilling is necessary. The only artificial means of protection recommended at this time is the practice of banking the trees to a height of 12 to 18 inches with dirt. The more sandy or loamy top soil is more desirable for banking than is clay. These embankments should be made in early winter before there is any cold weather, and should not be pulled down until after all danger of freezes has passed. Following the severe freeze of 1917 when many trees suffered injury in South Alabama and South Mississippi an investigation (7) in the former state revealed that 54.5% of the growers did not practice banking before the freeze mentioned. The remaining 45.5% banked to a greater or less extent, and these growers reported that 68.5% of their trees were saved which would have otherwise been damaged. On January 6, 1924, a sudden drop in temperature to 12° F. killed the then four-year-old trees at this Station to the banks. These trees were cut back and at the end of the growing season of that year these trees had made several feet total growth as is seen in the photograph in Plate 4. A report from this station for 1925 shows that one tree in this orchard made 107 fruits that year, and the 1926 report shows that a maximum number of 10 dozen fruits were made on these trees. Protection of the base of the tree by banks enables the strong root system to force out a new framework for a tree early after cold injury.

HARVESTING AND MARKETING

In harvesting satsumas the fruit should be clipped rather than pulled from the stem. Various patented types of harvest-
ing shears are on the market, and can be obtained cheaply. Picking bags are preferred instead of baskets as they are more convenient. Good field boxes should be provided to handle the fruit from the orchard to the packing house without excess bruising. Grade the fruit carefully, giving the buyer the benefit of any doubt about a cull. Class the oranges as brights or russetts, and then divide each class into at least two grades. It should be wrapped in printed paper, and packed so that a solid, uniform, and full package can be offered the market. The fruit is put up in half-boxes or straps, and these should be labeled as to name, quality, and size. Different sizes of satsuma oranges make necessary different styles of packing. Below are illustrated the various packs used.

Whenever possible the grower should become affiliated with cooperative marketing organizations, as this will prove invaluable in the orderly marketing of this crop of fruit.

Fig. 6. 90s, 3 inches, 3 layers, 15 fruits each layer.

Fig. 7. 120s, 2 3/4 inches, 3 layers, 20 fruits each layer.
Fig. 8. 168s, 2½ inches, 4 layers, 21 fruits each layer

Fig. 9. 216s, 2½ inches, 4 layers, 27 fruits each layer

Fig. 10. 76s, 3½ inches, 3 layers, 13 fruits layers one and three and 12 fruits layer two.
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