The Satsuma Orange in South Mississippi

By

E. B. Ferris and F. B. Richardson

Cluster of Oranges on a Satsuma Tree, Coastal Plain Experiment Station, McNeill, Mississippi

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director
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F. O. Cork, B. Sc. ................ Supt. Farm Management Vocational Project.
R. G. Reeves, B. Sc. ............... Fellow in Plant Breeding.
H. B. Brown, Ph. D. ................ Collaborator.

Experiments With Citrus Fruits at McNeill, Mississippi
1908 to 1923

By E. B. FERRIS

Introduction. On October 12th, 1907, the writer pulled his first orange from a tree. This was a Satsuma and was grown in Pearl River County. Having been reared in a more northern latitude and at a time when the small boy seldom saw an orange except at Christmas, we had always associated a place where oranges grew as a sort of fairy land and the time with that happiest of all seasons—when Santa was expected, so this experience made a lasting impression. We had on more than one occasion visited the orange belt of Southern California, a fairy land in itself, but at a season when oranges were not ripe, and had seen the great potential value that the ability to grow Citrus fruit gave to any soil, so it was not hard, even as far back as 1907 to foresee the great possibilities for South Mississippi as a citrus section. The place where these Satsumas grew was the home of Mr. John J. Amacker, eight miles west of Poplarville and ten miles north of McNeill. These trees had been set out in 1901 and at the time referred to had been bearing since 1904, had never been given any protection from the cold, nor had they been seriously affected by any insect pest or plant disease. It may be well to say here that these two trees still stand in Mr. Amacker’s yard and he tells us they have never failed to bear respectable crops every year, more often than otherwise having to be protected against breakage from too much fruit, and that with better attention in recent years the trees have taken on new life and are continuing to thrive.

As soon after this experience as possible there was set out on the station at McNeill a small number each of several kinds of citrus trees including Satsumas, Lemons and Citranges, the latter being a cross between the sweet and trifoliate (Citrus sinensis x Poncirus trifoliata) orange and much hardier than the former. From the experience of this planting of citranges we feel sure they will stand the climate at least as far north in Mississippi as the A. & V. Railroad and that the best of them might well be worth growing for home use.

Citranges. On January 8th, four varieties of Citranges, furnished by the United States Department of Agriculture, were set out at McNeill. These included three Colmans, four Savage, five Rustic, and three Morton. On the following 31st day of December all these trees were living except two and about this time an additional planting was made of six varieties of lemons of one tree each with an equal number of Satsuma trees. These plantings were made along an avenue extending from the road to the station buildings. No protection, except banking the lemons and Satsumas, was given any of these trees and one year from that time all the lemons were dead while all Satsumas and Citranges were alive and growing nicely. Continuous observations have since been made on the Citranges and up to 1923 all trees, except as noted above, are still living. Only one of the va-
rieties, the Morton S. P. I. 16872, would seem to have any practical value. The other three varieties bloom and bear freely but the fruit is not edible, is generally poorly shaped, often splitting open on the tree, while the trees themselves, except for the very fragrant blossoms, are not attractive. The Morton is very ornamental, large and shapely, blooming and bearing over long periods of the year and developing a fruit that is large and well shaped and which makes a delightful ade or with sugar a good substitute for the grape fruit. This Morton variety would be well worth growing for its ornamental features alone as it, too, has a very fragrant blossom. These trees are shown on the extreme left of the illustration in this bulletin.

View of Satsuma grove at Coastal Plain Experiment Station, McNeill, Miss., with Citrange Trees showing in the fore ground at the extreme left.

Work with Satsumas. On the strength of this success with these original plantings the succeeding legislature was asked for and gave $200 for additional work with oranges and in the fall of 1911 this money was spent in planting a little more than two acres of land largely to Satsumas. At that time the McNeill station was being operated on a very meager support fund with only one scientifically trained man, the director in charge, to plan and keep the records in every branch of station work which included dairying horticulture, agronomy and the keeping of office accounts. Therefore the experimental features of this work with oranges may not have been as comprehensive as they should, nor the data kept as complete as might be desired. Too, the years immediately following the setting of this orchard were not such as to lend help to an experiment that necessarily had to extend over a long period of time. These years were full of uncertainties for our particular station as well as for the branch stations of the state as a whole. At all times the legislatures disputed the right of the branch stations to live; there was seldom a session that did not debate a bill to abolish them;
and at one time the bills for the support of these stations was vetoed by the governor; while in the end the McNeill station had to choose between its removal to Poplarville or its probable abandonment entirely.

At the most critical time in the development of this orchard this change did take place and seemingly only by chance or the will of the Almighty were the authorities successful in getting a department of the Federal government to take over the old station ground and thus make possible the continuation of this work. Even when this was done it was taken over by the Bureau of Animal Industry, a department interested in an entirely different line of work, that of cattle, sheep and hogs and the growing of feeds for them. The Satsuma orchard might still have met an ignominious end had not the director in charge, Mr. S. W. Greene, have been a practical tree man before he became a scientific livestock man. As it was, it took time for him to become impressed with the possibilities of this fruit and to give them the protection against animals that were supposed to have first place with him. As a matter of fact, the orchard up to that time had never come into profitable bearing due to age and to two most unfavorable years and neither Mr. Greene nor the writer had come to so thoroughly appreciate the importance of this orchard as its subsequent behavior warranted.

At the time this work was started we knew little about the best methods of Satsuma production, fertilization, spacing, pruning, etc. and the methods of procedure with all these things were based largely on common sense rather than on precedent. The object of the work was largely to determine whether these oranges could or could not be profitably grown in South Mississippi, but as many experimental features as conditions would permit were injected into the work. An effort was made to determine if it were practical to grow the round oranges and grapt fruit and, if so, the best varieties of the same; the cheapest and best Satsuma trees for planting; while later it was intended to include work with fertilizers, spraying, and such other things as time might prove to be necessary.

The ground selected for this work was on the north west side of the place, on the top and side of one of the highest hills on the station enclosure, this hill sloping gently to the south. This land had been cleared in 1902 and a record had been kept of its history from the time of clearing to the time of setting to these oranges. In a soil survey made of the McNeill area in 1902 by the Bureau of Soils U. S. Department of Agriculture this particular land had been classified as Orangeburg Fine Sandy Loam, this being a sandy-loam surface soil underlaid by a sandy-clay subsoil of a deep red color. The land was prepared as for any other crop and laid off into squares twenty feet apart, the land being level enough to plow in any direction without serious erosion. The trees were furnished by the Glen St. Mary Nursery Company, Glen St. Mary, Fla., and were shipped from the nursery on Nov. 30th, but did not reach McNeill until December 15, were heeled out, and planted on December 21. They were promptly banked to protect them against cold and this practice was continued each winter thereafter, these banks being reinforced later when severe cold spells were imminent.

This main planting included twelve trees each of the following varie-
ties of round oranges: Ruby, Parson Brown, Carlton, Madame Vinous, Dugat and Grape Fruit. Also twelve trees each of the following sizes of Satsumas grafted in trifoliate stocks: 1 to 2 feet; 2 to 3 feet; 3 to 4 feet; 4 to 5 feet; 5 to 7 feet. The balance of the orchard was planted to 172 Satsumas 3 to 4 feet.

Early in the succeeding spring these trees were fertilized with a mixture of equal parts cottonseed meal and acid phosphate at the rate of one-pound per tree, this being mixed with the soil with hoes as the mounds of dirt were pulled away from the trees. This application of fertilizers was continued each year and increased as the trees got older until they finally received several pounds per tree yer year. Various crops were grown between the trees such as Irish potatoes, cabbage, sweet potatoes, cowpeas and soy beans when the plan was finally adopted of growing soy beans every year, these being grazed off each year by hogs. When a non-legume was grown in the orchard these were fertilized with nitrogen and phosphorus and when a legume was grown it received phosphorus alone in the form of acid phosphate, usually at the rate of 300 pounds per acre.

Little pruning was done to the trees further than to keep dead limbs removed and occasionally to cut out branches that appeared too thick. The shape of the trees was never as symmetrical as with most other fruits, but in the absence of any better knowledge it was decided to let nature take its course.

At the end of the first year the following numbers of the twelve trees each of the several varieties had died: 7 of the Ruby; 8 of the Pineapple; all of the Parson Brown; 5 of the Carleton; 9 of the Grape Fruit; 6 of the Madame Vinous; and 10 of the Dugats. Also the following number of the several sizes of Satsumas: 7 of those 1 to 2 feet; 1 of those 2 to 3 feet; none of those 3 to 4 feet; 1 of those 4 to 5 feet; and 1 of those 5 to 7 feet. Of the 112 Satsumas 4 to 5 feet required to complete the orchard, thirty were dead at the end of the first year. The high mortality was attributed to the length of time required for the trees to reach their destination by freight and the nursery was good enough to furnish sufficient trees at half price to replace all that had died the first year and to ship these by express. The orchard was reset Nov. 30, 1912 with Satsumas 4 to 5 feet and the several original sizes and varieties were not replaced with their kind.

About such cultivation was given from year to year as was commonly practiced with other fruit trees. The crops grown between the middles worked while the tree rows were kept clean with cultivators and hoes. The practice of growing soy beans in rows between the trees and grazing these off in the fall with hogs proved the most satisfactory. While men and hogs have many habits and tastes in common, this does not extend to oranges, for the hogs never disturbed the fruit at all even though it hung on the trees in easy reach of their noses, while the best of wire fences, with notices to ‘‘Stay out, this fruit is poisoned’’ was not sufficient to keep men out of this orchard.

In 1913 a number of young oranges were found on the trees 5 to 7 feet as taken from the nursery row, but on no other tree in the orchard. In the fall of 1914 it was noted that a number of these trees had borne a
few oranges: The Satsumas 1 to 2 feet had no fruit; of those 2 to 3 feet, 4 trees had 12 oranges; of those 3 to 4 feet, 6 trees had 26 oranges; of those 4 to 5 feet, 2 trees had 2 oranges; and of those 5 to 7 feet, 5 trees had 25 oranges. The greatest number gathered from any one tree that year was ten oranges.

In September 1915 there came a severe gale which blew off a large part of the oranges and no attempt was made to keep records of the trees such as had been kept the year before, but it was noted that even with the number blown off there was a considerable increase over the number ripened the year before.

The round oranges had continued to die and in February of 1916 twelve Grape Fruit trees were set in the missing places of these round oranges. These were dead at the end of the year. In the fall of 1916 a fairly good crop of oranges was gathered notwithstanding the terrible July storm of that year which did so much damage to all crops of this section. About twenty-five half straps were sold this year at $1.50 each. The storm above referred to blew all limbs, leaves and bolls from cotton and all but blew the plants out of the ground, so much destruction was wrought that on our station we did not attempt to pick cotton that before the storm had promised a bale to the acre. More than twelve inches of rain fell in thirty-six hours during this storm and streams rose to unheard of proportions. It speaks wonders for the Satsumas that they survived this storm and the hard winter that followed it. In the fall of this same year the following observations were made with reference to the several varieties other than Satsumas: only one Ruby alive; 3 of the Pineapples alive and well fruited; all Parson Brown dead; 1 Carlton alive; all grape fruit dead; 4 Madame Vinous living and these well fruited; 4 Dugats alive, of fair size and well fruited.

In the fall of 1917 about thirty half straps were sold from the orchard at $1.50. We cannot pretend to say that the figures given represent even approximately the number of oranges borne by the trees. This orchard had a public highway on one side and private roads used by the general public on two other sides. Oranges were entirely new to the public and the impression all too common that what belongs to the state belongs to the individual was peculiarly abroad in that land so that a great many of these oranges stuck to hands that had no right to them.

The legislature of 1918 authorized the removal of the station from McNeill to Poplarville and all experimental work was discontinued at McNeill and started at Poplarville. After that year Mr. S. W. Greene of the Bureau of Animal Industry, U. S. Department of Agriculture took charge at McNeill and in 1918 and 1919 we have no records of yields of this orchard. In 1920 Mr. Greene numbered each tree, or the place of each tree, in the orchard and began keeping individual records of these trees. As in previous years it was found difficult to prevent pilfering, but these records show that in 1920, 2888 oranges were gathered from the orchard with 187 as the largest number from any one tree. In 1921, 5,403 oranges were gathered from the orchard with 228 as the largest number from any one tree. In
1922, 35662 oranges were gathered from the orchard with 1100 as the largest number from any one tree.

From the time of setting through 1922 this orchard was never systematically sprayed and only twice was it sprayed at all and that against the white fly with Schnarrs Insecticide. A peach orchard set out several years later on an adjoining plat of land had been sprayed regularly up to the time of our leaving McNeill and had borne two crops, in two years after this, without spraying had died completely from San Jose scale. This to show the comparative freedom of the Satsuma from insect pests and not as any argument against spraying, for doubtless the trees would have done much better if they had been sprayed, while now there are doubtless many newly introduced troubles that were not apparent ten years ago.

Notes made on this orchard early in 1923 showed that a large part of the round oranges had died and been replaced with Satsumas and of the few remaining all were sprouts from the trunk beneath the soil mound. There was one sprout from the Ruby; three from the Pineapple; none from the Parsons Brown; five from the Carlton; four from the Madame Vinous; and four from the Dugat. There were thirty-eight missing trees in the orchard. No observations had been made regularly as to the difference in sizes of the several plantings of the Satsuma trees but as they stand in the row now the smallest original planting, those one to two feet as taken from the nursery row, were as large as the largest original planting, those five to seven feet. This would indicate that there is no use spending money for extra large stock. In the beginning the very small trees died badly the first year, possibly due to their having dried out worse in shipment or to the very cold winter that followed immediately after planting. However, the next size or those two to three feet as taken from the nursery row, lived and grew off as well as any other size used.

Our criticism of this orchard, based on what we have seen of other orchards, is that the trees have developed too little growth. This may have been caused by improper cultivation, to our having grown crops too long between the trees, or to a lack of proper kind and quantity of fertilizers. At any rate, no tree in the orchard compares in size with a few trees planted later on the Weston farm near Logtown. The trees at McNeill were all Satsumas on trifoliatia stock while those near Logtown were Satsumas on rough lemon stocks. These last named trees are practically twice as large as the ones at McNeill and one of them bore 3800 fruits in 1921.

The work with these oranges clearly shows that the round oranges, grape fruit, and lemons are not sufficiently hardy to recommend for commercial plantings, though they are being grown for home use all over this section; the Citranges are exceptionally hardy and vigorous, but produce fruit of low quality; the Satsumas have been winter hardy, they produce satisfactory yields of fruit of high quality, and are increasing yearly in proportion to the amount of wood growth produced.

Put out as a minor project with no previous work in this section to serve as a guide in its management, this orchard has developed into one of the best paying crops on the station.
As soon as possible after the removal of the station from McNeill to Poplarville, appreciating the importance of fruits in general and oranges in particular to South Mississippi, our station employed a regular horticulturist and started new work with Satsumas. This work has not advanced to the stage where any experimental data has been accumulated, but the plan of the work has been well conceived by a man trained as a scientific horticulturist. This man is Mr. F. B. Richardson, who has made quite a study of Satsuma oranges in connection with this new work, has traveled widely over the orange belt interviewing the best growers of this fruit, and who, in this publication, has been asked to prepare the main body of the bulletin in which is discussed the Satsuma production from all angles, giving the best and most approved methods as determined by his own and the experience of a number of the best growers. The accompanying table gives a fairly complete record of maximum and minimum temperatures and rainfall as kept by us through 1918 at McNeill and since that time at Poplarville. It more than covers the life of the orchard at McNeill and practically covers the life of the two Satsuma trees as mentioned in the opening paragraph of this bulletin. Such a table should be invaluable in making a critical study of the possibilities of commercial Satsuma production in this section as a whole.
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The Satsuma Orange in South Mississippi

GROVE MANAGEMENT AND REQUIREMENTS FOR COMMERCIAL PRODUCTION

By F. B. RICHARDSON, Horticulturist

Introductory. The Satsuma Orange is a native to China and Japan, indications being that it first originated in Japan, where there are bearing trees more than 300 years old. It was first introduced into the United States in the Gulf Coast section of Mississippi about 1895. The industry has grown until there are possibly more than 20,000 acres of this citrus fruit, with the bulk of the plantings in Mobile and Baldwin Counties, Alabama. With the opening of suitable land in South Mississippi, the Satsuma Orange has gained rapidly in this State, and numerous inquiries from prospective planters regarding it make a publication on the subject imperative.

The Satsuma groves in this State are located mainly in Harrison, Jackson, Pearl River, Stone, Hancock and George Counties, at or near the following places: Ocean Springs, Biloxi, Gulfport, Long Beach, Pass Christian, Bay St. Louis, Carriere, McNeill, Poplarville, Lumberton, Lyman, Wortham, McHenry, Wiggins, Fruitland Park, Lucedale. There are other scattered plantings in the six counties named, but the chief locations are those given. The largest commercial grove of bearing age at present is on the Swan Company property, two miles east of Lyman. This is a 6500 tree planting which has been given first class attention, and which made an exceptional yield in its fourth season, in 1922. At Carriere a large com-

Satsuma Grove, Lyman, Miss. Fourth year from cut-over land
mercial development is in progress. Near McNeill, 1000 acres have recently been purchased for the purpose of planting exclusively to the Satsuma. An extensive commercial development is under way at Hovey. The J. J. Scarborough twelve-year grove at Poplarville has been very successful, the same being true of more recent plantings at Lumberton. Probably the largest combined acreage of bearing trees in any one vicinity is near Wiggins, there being a total of at least 150 acres. The experience gained from these older plantings, where under correct practices wonderful yields have been secured, has given much encouragement for greatly increased acreage. It is the purpose of this publication to point out the requirements of success as far as they have been determined. Experiment Station data on the subject is quite limited, so that it has been necessary to get much of the data presented herewith from various reliable sources, credit for which is fully acknowledged.

The Satsuma Orange belongs to the Mandarin group, of which the China Mandarin and Dancy Tangerine are also varieties. The Satsuma is superior to any of its group for this section; the shipping qualities are good, it is ready for the market ahead of oranges from competing sections, and has become very popular in the few consuming markets to which it has been shipped. It is very high in per cent of juice, while the distinctive blending of citric acid and sugar content give it a delightful and highly refreshing quality. In addition, it is practically seedless. The Satsuma and other varieties of the Mandarin group are sometimes called "Kid Glove Oranges" from the fact that the peeling can be removed so easily, and the sections separated, without squirting juice on the hands and clothes. It is primarily a high class dessert fruit and is destined to become one of the leading, if not the most important citrus fruit on the market.

Selection of a Locality and Site for a Grove

In the last analysis the exact location of the grove site is the deciding factor in establishing a commercial grove. Considering the general locality the prospective grove investor would be interested in a favorable climate as to healthfulness; good water; schools and churches; good transportation facilities; and the general freedom of the region from frost injury. If the general locality and the particular orchard site are both favorable, conditions are of course ideal.

With reference to the climate prevailing in these six counties, the following is quoted from a Bulletin by the U. S. Bureau of Soils: "* * * extremes of both summer and winter being tempered by proximity to the Gulf of Mexico. This is especially noticed in the summer, when winds from the south are delightfully cool. The summers are long, but not oppressively warm. The winters are mild and the few cold spells are always of very short duration." (From Bulletin of Soil Survey of Pearl River County, Miss.)

The question is often asked, "How far up from the Gulf Coast can the Satsuma be safely grown on a commercial scale?" The definite northern limit cannot be given with certainty. The districts where this citrus fruit has been grown for a number of years is the only basis on which to judge. The late G. A. Swan, one of the successful pioneers in Satsuma culture,
states that "Satsuma trees will stand when absolutely healthy and perfectly dormant, a temperature of from 12 to 14 without injury." In the Mississippi districts mentioned, the apparent limiting factors to successful commercial culture have been proper grove site, with good management in cultivation, fertilizing, and spraying.

The grove site should certainly have good air drainage, which is natural to uplands unprotected by windbreaks. Windbreaks of trees surrounding table lands, or at the bottom of slopes, prevent air circulation, and should be partially, if not totally removed. If a site is chosen with respect to good air drainage, proper soil drainage usually follows. Certainly the Satsuma grove should not be planted on wet lands. Close proximity to the Gulf would not be a deciding factor in the selection of grove site, as denoted by a number of successful groves several miles removed from the Coast.

Grove sites with an elevation of twenty-five feet or more above the surrounding country should be very desirable. In this connection, the variation in temperature at the base of a hill in mountainous country, and at different heights above, on a clear, still night is discussed in detail in Farmers Bulletin 1096. At the base of the hill, the lowest temperature during the night was 25 degrees; 25 feet above on the hillside, minimum was 30 degrees, and 50 feet up, 44 degrees. In addition, the 25 temperature lasted three hours, while the 30 degrees held for only a few minutes. At the base it was below freezing a total of 11 hours, while 25 feet above the temperature was barely below 32 a total of six hours.

As to soil requirements for the grove site, it may be said that in general most of the soil in the Satsuma belt which is suited to agricultural crops is satisfactory for Satsuma culture. Some growers claim that too light a soil is liable to start the trees into growth too early in the spring, though there is no experimental data regarding Satsumas to support this statement. The subsoil should certainly be substantial enough to be retentive of fertilizers, and there is an abundance of soil of this character.

To summarize the requirements for a desirable grove site, good air drainage is especially important, combined with satisfactory soil drainage and a good agricultural soil which is retentive of fertilizers. If the requirements for a good grove site can be combined with a locality having good schools and churches, transportation facilities, abundant supply of good water and favorable climate, the opportunity for success is highly favorable.

Preparation of Land for Planting. If cut-over land is purchased the first work involved is removal of stumps. The method most commonly employed at present is burning. A good method observed recently was to dig a hole two to three feet deep on an angle at one side of the tap root, and a second hole at an angle from the other side until it met the first one. This gives a V-shaped opening down by the side of the stump, with the bottom point of the V in contact with the tap root. Fire is started in the hole on the windward side of the V and the other hole acts as a flue, producing a good draft. The tap root is burned through after which the remainder of the stump can be dragged out and used to kindle the next stump. Bulletin 159 of the Mississippi Agricultural Experiment Station "Clearing Pine Lands," describes several methods in detail.
After clearing the land of the stumps, all slopes and rolling lands should be terraced to maintain the original fertility and to arrest soil erosion. The terraces and their outlet ditches may effect tree location, thus their construction should precede planting. Following this, the land should be plowed six to eight inches deep, a tractor with disc plows being especially suitable for the work. After plowing, disc the land thoroughly until the soil is well pulverized and settled. If the preparation of the soil is done thoroughly, there is no good apparent reason why the trees should not be planted the first year on new land, without waiting to crop the land one season. Unless all rotten wood has been thoroughly destroyed, there is danger from wood lice.

Selection of Satsuma Varieties for Planting. Commercial citrus fruit culture in this section should be confined at present to the Satsuma Orange. It will have to be admitted that preliminary tests at Lyman with round oranges, which include some of the best Mediterranean varieties, have been very encouraging; the trees have borne heavy crops of high quality fruit, which ripens earlier than the same varieties in competing sections. Grape fruit has also done well, though it is not advised with the present limited information available to make commercial plantings of either the round orange or the grape fruit. From an economical standpoint also, by concentrating all efforts on the Satsuma, markets will be more easily established and retained.

There have been three varieties of Saturnas grown in the Gulf Coast section: Owari, Ikeda, and Zairai. Plantings are devoted now to the Owari and Ikeda only. Ikeda is nearly spherical in shape, while the Owari is flattened, with a depression at both the stem and blossom ends. Owari is two to three weeks earlier than Ikeda and of better quality. There is considerable difference of opinion as to trueness to type of these two varieties, and it is possible that only through careful bud selection will true strains be developed and maintained.

The United States Department of Agriculture is testing out other varieties in addition to those mentioned above, among which Wase appears very promising.

As to the size of nursery stock for planting it is not considered advisable to plant anything larger than two to three foot trees. An orchard was planted in Poplarville in the spring of 1921 with two to three foot size Satsuma trees, and a four to five foot size. At this date there is no practical difference in the size of the trees which have been given identical treatment. The initial cost of the small trees is less, and in addition there is less expense involved in transportation charges and planting.

Setting the Trees. While many growers set the trees in December and January, February is likely the most ideal time. In February the weather is usually more favorable, and the trees are ready to start into growth by the first of March or soon thereafter. Set the trees in squares twenty-five feet apart, which will require seventy to the acre. Set the trees to such a depth so that when the soil settles the tree will stand at practically the same depth which it did in the nursery row. It is doubtful practice to
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Cultivation. Continuous clean cultivation should be given the orange grove from early spring until October, the object being to carry the trees through to winter in a thrifty condition. Cultivation need not be any deeper than necessary to maintain a good soil mulch for the conservation of moisture. The double disc harrow with extensions and shields adapted to orchard work, and drawn by a tractor, is a good combination to use in groves large enough to justify power equipment. Unless the winter cover crops have made an extremely heavy growth, the double disc harrow will work it into the soil without the help of a plow. For a horse drawn cultivator, the spring tooth harrow will do satisfactory work. The number of cultivations will be determined by the frequency of rains in the locality; the object should be to maintain a good soil mulch throughout the entire season.

Cover Crops. The soils throughout the Satsuma Orange belt are greatly improved by the use of cover crops or animal manures. Since manures are difficult to obtain in sufficient quantity, cover crops are used extensively to increase the humus content of the soil. A cover crop is grown primarily for the benefit of the trees and the hay from the crop should not be removed, but should be worked back into the soil. Cow peas or soy beans are ideal cover crops for this section. Plant in rows which can be cultivated until the cover crop takes the ground. In a young orange grove retain a six to eight foot space for each tree row, which should receive clean cultivation through September. The cover crop may be planted in the latter part of June, or through July. As soon as the cover crop is harvested in groves of bearing age, or in October or November for young orchards, plant a winter crop of oats or rye plowing under the following spring. Under no circumstances should the oats or rye be allowed to mature.

Intercrops. Unless land is very limited intercrops are not advisable. They interfere with the work of cross cultivation with the larger implements such as the disc harrow, thereby increasing the amount of hoeing to be done about the young trees. In the case of small groves, however, and where cash crops are desired from the spaces between the tree rows, several truck crops may be used to advantage during the first two years: tomatoes, peppers, radishes, beets, carrots or beans being good ones to use.

Fertilizers for Satsuma Oranges. For young trees during the first three years in the grove, use a 6:4:4 fertilizer mixture. Apply the following amounts twice per year, at the first of February, and first of July:

First year, 1 pound.
Second year, 1¾ pounds.
Third year, 2¼ pounds.
For bearing trees, from the fourth season on, use an 8:4:6 fertilizer mixture. Apply the following amounts twice per year, at the first of February, and again at the first of July:

- Fourth year, 3 pounds.
- Fifth year, 4 pounds.
- Sixth year, 5 pounds.
- Seventh year, 7 pounds.
- Eighth year, 10 pounds.

After eighth year, apply amounts in proportion to age, condition, and crop present.

Materials and amounts for home mixture—The above figures apply to a standard fertilizer mixture, such as is made in fertilizer factories, to give a definite percentage of the fertilizer elements per ton of fertilizer mixture. If it is desired to mix the fertilizers at the grove, the following is recommended:

For the 6:4:4 mixture for young trees, use 300 pounds acid phosphate, 213 pounds Nitrate of Soda, 64 pounds Sulphate or Muriate of Potash. This will give a more concentrated mixture than a standard 6:4:4, and accordingly less weights per tree are required. Use as follows:

- First year, \( \frac{3}{4} \) pound per tree.
- Second year, \( 1\frac{1}{4} \) pounds per tree.
- Third year, \( 1\frac{3}{4} \) pounds per tree.

These weights to be applied twice per year same as above. The 6:4:4 formula for home mixing may be roughly approximated as follows: 3 100-lb. sacks Acid Phosphate, one 200-lb. sack Nitrate of Soda, two-thirds of a 100-lb. sack Sulphate or Muriate of Potash. This will mix up enough for 750 first year trees, one application. For 75 trees, one application in the first year, 1-10 of these amounts would be used, for example, 30 lbs. acid phosphate, 21 pounds nitrate of soda, 6\( \frac{1}{2} \) pounds Sulphate or Muriate of Potash. For the 8:4:6 home mixture for bearing trees, mix up 600 pounds acid phosphate, 300 pounds nitrate of soda, 144 pounds Sulphate of Potash. Use this form of potash only for the bearing trees. Use following weights per tree twice a year:

- Fourth year, 2\( \frac{1}{2} \) pounds.
- Fifth year, 3\( \frac{1}{2} \) pounds.
- Sixth year, 4 pounds.
- Seventh year, 5 pounds.
- Eighth year, 7\( \frac{1}{2} \) pounds.

Distributing the fertilizer: If the home mixture is used, it may be prepared in the bed of a wagon, and hauled directly to the grove. Mix the material thoroughly, being careful to break up all lumps.

In order to get a measured amount of the fertilizer to each tree, use a can or bucket cut down to the desired capacity. While it is not expected that the precise weights indicated per tree should be used, still the weights applied should be reasonably close to those given in the table.

The fertilizer may be scattered in a trench four inches deep around the young trees, or it may be broadcasted close to the tree. For the first year
trees, the trench should be one foot away from the trunk; second year, 2 feet; third year, 5 feet. Thereafter up to the time of broadcasting the fertilizer in the middle, make the trench at about the droop of the outer branches, at which place the feeding roots are most abundant. Another method for applying the fertilizer to young groves is to plow a furrow on four sides of the trees at the desired distance from each, and scatter the fertilizer in these square trenches made around each tree. Cover back with the plow. If it is desired to broadcast the fertilizer to the young trees, apply at the distance from the trunk indicated above. Work the fertilizer into the soil immediately to prevent washing away by rains.

The second application of fertilizer given early in July is often varied to suit the conditions. It may be that the tree will require more or less than the amount indicated for the second application. Let the condition of the tree guide the amount of application.

These fertilizer formulas and instructions are based on recommendations used by the Harrison County Citrus Growers Association, (Branch of Gulf Coast Citrus Exchange). The Gulf Coast Citrus Exchange mixes its own fertilizers which are sold at cost to members of the Exchange.

Injurious effects of fertilizers. Excessive applications of fertilizers have been found to be injurious under Florida conditions. (1). The amounts given in the above schedule, however, are standard. Applications of lime have also proved harmful to the growth of the tree, causing a stunting, and furring of the foliage. The excessive use of barnyard manures tends to produce a thick-skinned, puffy fruit of inferior quality. Excessive applications of Nitrate of Soda are claimed by one Louisiana grower to have caused the fruit to ripen two to four weeks later than properly fertilized trees of the same variety. Too much nitrogen will also cause the tree to make a sappy growth late in the season, subjecting the entire tree to frost injury. Kainit and Muriate of Potash are undesirable sources of Potash. The muriate may be used on young trees without any apparent ill effects.

Sulphate of Ammonia may be used in the home fertilizer mixtures instead of the nitrate of soda. The weights given in the schedule, however, do not apply when sulphate of ammonia is used, and it would be necessary to change the applications to give results equivalent to the nitrate of soda.

Control of Insects and Diseases. Spraying is an essential part of profitable citrus fruit production. In California, fumigation in addition is necessary, and is a costly process. Fumigation has never become necessary in this section and likely never will, judging from the success attained by consistent spraying both here and in Florida.

The most important pests of the Satsuma are the White Fly, Chaff Scale, Purple Scale, Florida Red Scale, Rust Mite, Red Spider. There are several of minor importance, but the spray materials used in the control of those named have proven to be effective for the ones of lesser importance. The caterpillar of the Orange Dog Butterfly may cause some damage to young trees by partial or complete defoliation, though with reasonable at-

tention by the grower, this insect is easily kept under control. The caterpillars are usually scattered over only a small per cent of the trees, so that hand picking is a practical means of control.

In common with all cultivated fruits, the Satsuma Orange is also subject to certain diseases which must be kept under control for best results. Citrus canker and citrus scab are of main importance at present. Citrus canker has been practically eliminated by the active work of the various State Plant Boards and U. S. Bureau of Plant Industry, while citrus scab can be effectively controlled by timely applications of Bordeaux Mixture sprays.

Many of the citrus troubles common to the older citrus sections are apparently not of much consequence to the Satsuma. By following standard cultural practices, the Satsuma grower should continue to enjoy this freedom from pests common to the older districts. New plantings should certainly reap the benefit of the pioneer experience accumulated in other sections.

Close attention should be given to new plantings the first season. Watch for white fly and purple scales especially. Citrus scab often appears at the start of the second season. As soon as any trouble develops start a vigorous campaign for its control. Do not wait until the tree has become weak and stunted by attack of insects and diseases.

In spraying for disease, prevention should be the object, rather than cure. Precede the entrance of the disease to the tree or fruit by timely applications of fungicide. In case the disease has already gained foothold, spray to prevent its further spread. After scab has once gained entrance to the tender fruit or leaves, no amount of spraying will cure the trouble on the diseased parts, and spraying should then be done to prevent further spread of the infection. For insect control the use of insecticide sprays before any insects appear would of course be useless. However, the orange grower may reasonably expect some insects or diseases the first year of two, and accordingly should make advance preparations for their control. While the Satsuma Orange tree has been able to stand more neglect than the peach in this section, from a commercial standpoint such neglect would mean failure. Even growers of Satsumas for home use should give the best of treatment to this fruit; home orchards should not be allowed to continue as breeding places for disease and insects.

Various ornamentals harbor the citrus white fly, one of the worst pests on the Satsuma. Plantings of the following ornamentals should be discontinued: Chinaberry trees; Gardenia (Cape Jessamine); Privets. These should certainly not be planted about homes where orange trees are desired. Hedges of Amoor River Privet swarm with white fly during the summer months and are difficult to spray thoroughly to eliminate this pest.

Spray Outfits. For the first three or four years of the orange grove the best makes of hand power outfits will do very satisfactory work at a minimum of expense in investment and upkeep. The following is recommended for a complete outfit: Double action hand pump (for mounting on platform outside of barrel or tank); equipped with double discharge pipe with cut-off for each; suction hose with strainer; presser gauge; agitator arrangement; two 35 foot leads of best grade spray hose ½-inch size, with
couplings; two 6-foot bamboo spray rods, aluminum or brass pipes, with shut-offs; single angle nozzle for each rod; tank, 100 gallon capacity preferred. A brass funnel strainer should also be included in the equipment.

A high grade hand outfit such as described will cost less than the lowest price gas engine power outfits and will give fine satisfaction while the trees are small. It is kept in good condition very easily, with few repairs needed. 125 to 150 pounds pressure can be maintained with two nozzles. Use a disc in the nozzle which will furnish a good spray fog at the highest pressure that can be maintained. The pressure should not be less than 125 pounds. As soon as more pump capacity is a necessity, purchase a reputable high-pressure outfit which will deliver ten to twelve gallons per minute at 250 to 300 pounds pressure. An outfit of this type will operate four leads of hose.

A convenient water supply will save valuable time. Records kept here at the Station showed that one-third of the total time, one-half hour, was spent in refilling a 50 gallon barrel outfit during spraying operations. The recent installation of a 500 gallon tower tank in the orchard, equipped with float valve and two inch discharge pipe and hose, delivers approximately 100 gallons per minutes and reduces the total time for refilling to about five minutes.

**SPRAY SCHEDULE FOR SATSUMA ORANGES IN MISSISSIPPI**

**Also Applicable to Other Citrus Fruits**

The extent of infestation and infection of insects and diseases should at all times govern the kind and frequency of spray applications. It is manifestly impossible to prescribe one set of treatments which would be equally applicable to each and every citrus planting, and because of this, no spray schedule should be followed slavishly. It is obviously poor management to spray for insect pests as indicated on the spray schedule when such insects are not present, and therefore the grower should thoroughly familiarize himself with the common insect pests and diseases of the Satsuma tree and fruit, so that the spraying operations may be done efficiently and economically.

**SPRAY SCHEDULE**

**Late dormant spray for Citrus-Scab, Scale Insects, White Fly, Red Spider:** Use Bordeaux mixture 3:3:50, plus one gallon oil emulsion in each 50 gallons of mixture. To be applied just before growth starts in the spring. Keep the diluted Bordeaux mixture agitated thoroughly, while adding the oil emulsion. The resulting mixture should total 50 gallons. The oil emulsion referred to here and in the following paragraphs refers to Yother’s Government Formula. Directions for preparing spray materials given below.

If weather conditions are so unfavorable that this application is delayed until growth is already starting, reduce the amount of oil emulsion to 3 quarts.

The oil in this mixture kills all red spiders hit by the spray. Since only a small percent of them would be hit by careless or ignorant workmen, it should be emphasized that a thorough job is essential at all times to effectively control insects, pests, and diseases. Too much stress can not be put
on the fact that it is absolutely necessary to cover every portion of the tree, including the trunk, limbs, twigs, and both the tops and under sides of the leaves. Practically 99% of the white fly larvae and pupae, and red spiders are on the under sides of the leaves. It is likewise essential to hit the under sides of the leaves to cover the old Citrus-Scab lesions, to prevent early spread of scab infections.

Second Spray for Scab: Use Bordeaux mixture 3:3:50 plus three pints of oil emulsion in each 50 gallons of mixture. To be applied after most of the blossom petals have fallen. The oil in this mixture acts as a spreader, increasing the efficiency of the Bordeaux; 1 pound fish-oil soap may be used instead of the oil emulsion. This is the important spray for protection of the young fruits from early scab infection, and they should be coated thoroughly with the Bordeaux. However, it is not necessary to drench the fruit and leaves.

Another scab spray two weeks afterward may be necessary if the weather has been favorable to growth of the scab fungus. Rainy or foggy weather favors scab.

Lime-Sulphur solution, 32 deg. Baume', 1:40, is not more than 50% effective against severe scab infection. (†).

Rust Mites and Red Spiders:

Use Lime-Sulphur solution, (32 degrees Baume), strength 1 gallon in 50. Rust mites and red spiders are most numerous in dry weather. In some years they are not numerous enough to be noticeable. The presence of these pests is the only guide as to time of application of Lime-Sulpher spray. In this locality, in favorable seasons, the first spraying will likely be necessary in June. Red spiders are usually very numerous during the mild winters on the Coast, and can be controlled by the oil sprays recommended in the following paragraph.

Dormant Season Sprays: One or two fall and winter applications of oil emulsion, one gallon in 50, may be necessary to clean up infestations of scale insects, white flies, and red spiders. On severe infestations of purple scale, the writer has used 1½ to 3 gallons of oil emulsion in 50, with effective scale control, and no apparent foliage injury. These strengths were used during the dormant period only, and due to extra heavy incrustations of scale, the extra strength used seemed justified. However, neither of the greater strengths has been tested sufficiently to advise its general use.

These dormant season sprays may be applied after November 1st, or after harvesting in the case of bearing trees, up to February first.

During July and August, watch for scale insects and white flies. Use oil emulsion, 3 quarts in 50 gallons for their control. When thoroughly applied, this spray should also be effective against rust mites. This spray is not a control for the adult stage of the white fly. Note the date when most of the adult flies have disappeared, wait two weeks and then spray. This will catch the flies in the larvae stage, when they are most easily killed.

In years of average disease or insect infections and infestations, the applications necessary, in their seasonal order, would be about as follows:

1. Late dormant spray for scab, scales, white fly, red spider.
2. Scab spray after most of the blossoms petals have fallen.
3. Application for rust mites and red spiders in June.
4. Oil spray latter part of August for scales, white fly, rust mites.

Nos. 1, 2 and 4 may be considered essential each year. No. 3 will be determined largely by seasonal conditions.

Preparation of boiled oil emulsion. Government formula. From Farmers Bulletin 933:

"Formula:
Paraffin Oil, 2 gallons;
Water, 1 gallon;
Potash fishoil soap 2 pounds, or one pound of hard soap.
Hard soap not so satisfactory; emulsion made from hard soap should be used the day it is made.

**Directions:** Put oil, water, and soap into a kettle or other vessel that will stand fire, and heat to the boiling point. While still very hot, pump the material into another vessel and then back again. Emulsion cannot be made by this formula without a pump; stirring is not sufficient."

A pressure pump is necessary for this work. Stirring with a paddle will not do. On the other hand, excessive pumping will break up a good emulsion.

**Test Spray Material:** Before mixing up the emulsion for spraying, it should be tested to see if it makes a perfect emulsion with the water. Test by adding a small amount of the emulsion to some soft water. If it mixes immediately, forming a milky-white solution with no grease or scum forming on top it will be satisfactory. If oil comes to the top it should not be used. Recooking with the addition of a little more soap will usually correct the condition.

It sometimes happens that deep well water or sulphur water is the only kind to be obtained for spraying. Under these conditions a weak solution of Bordeaux mixture: ½:½:50, should be added to the water previous to the addition of emulsion, in order to obtain a stable mixture.

Any heavy grade of lubricating oil testing 24 to 28° Baume’ will make a good emulsion.

Preparation of Bordeaux mixture, 3:3:50. In Bordeaux mixture formulas, the first figure refers to the number of pounds of Copper Sulphate (Blue Stone); the second figure is the number of pounds of fresh stone lime, and the third figure is the amount of total mixture resulting from addition of water.

Dissolve 3 pounds of Copper sulphate in a wooden bucket; slack 3 pounds of stone lime in another bucket. Pour these simultaneously into 30 gallons of water in the spray barrel. Maintain vigorous agitation in the spray barrel or tank while adding the stock solutions. Add water to bring the total up to 50 gallons. Bordeaux mixture should be agitated thoroughly while spraying.
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For filling a 200-gallon tank, four times the amounts given for 50 gallons would be necessary, and the copper sulphate and lime should be mixed separately in wooden tubs. Do not use iron or galvanized iron vessels for mixing Bordeaux. Two wooden tubs made by sawing a 50-gallon barrel in two, will be convenient for this mixing.

A high grade of fresh stone lime should be used. Air-slacked lime should never be used.

Bordeaux mixture should be used on the same day it is prepared.

Several commercial Bordeaux preparations are on the market. They are made in powdered and paste forms. The labels give the amounts to use. They

The heavy fruiting tendency of the young Satsuma tree. Extreme upright branches have been produced in this tree by the method of pruning. See discussion.
are easily mixed, and when used in strengths equivalent to the home made Bordeaux, should give just as good results. Where large quantities of Bordeaux are used, with time saving equipment such as convenient loading platform and mixing vats, it would doubtless be more economical to use the home-made mixture.

**Pruning:** Up to this time, very little pruning has been practiced on the Satsuma tree. This neglect is due in part at least to the fact that the industry is new, with little definite information on the subject; and to the fact that in the past, the trees have borne large crops under adverse conditions, causing the grower to be more or less self-satisfied. With the rapid expansion of commercial plantings, however, strict requirements for profitable production of high grade fruit has demanded an improvement in all cultural methods. Even yet, there has not been found necessary any elaborate system of pruning such as followed for most fruits, and while the present requirements for the pruning work are quite simple, still they are essential to the best success. The pruning operations may be divided roughly into three parts:

1. **Shaping the tree.**
2. **Removal of dead, diseased, and broken branches.**
3. **Removal of suckers from the stocks.**

1. **Shaping the tree.** A low head is most desirable, with the main branches starting six to twelve inches from the ground. Three to five main branches are sufficient. As these branches have a distinct tendency in two or three years to droop to the ground, when loaded with fruit part of the crop is damaged for commercial use by coming in contact with the soil. Also, in extreme cases, under heavy loads of fruit the main branches may split from the trunk. These troubles may be averted, not by high heading of the tree, but by pinching or clipping off the ends of the drooping branches, to stimulate the growth of a number of upright shoots on the main branches. An "open head," such as recommended for the peach, is not desirable for the Satsuma, though crossing branches which are obviously injurious because of rubbing, should be removed. Some of the highest quality fruit of the Satsuma is borne on the interior of the tree, where there is very little direct sunlight.

In shaping the tree, therefore, aim to secure a low head, with upright branches, and well balanced top.

2. **Removal of dead, diseased, or broken branches.** This should be done promptly, at any time of the year that the dead, diseased, or broken branches are noticed. Do not wait until a certain "season" to do the work. In all pruning work, and especially with the removal of larger branches, make the cut flush with the part from which the branch is removed. Never leave a stub. In the case of newly set trees, there is often a slight dying back of the small branches. Keep the dead portions cut back to live wood; this work should be given close and frequent attention until all the branches have started into vigorous growth.

3. **Removal of suckers from the stock.** When suckers start from the seedling stock on which the Satsuma is budded, they should be removed.
promptly. Shoots from Citrus trifoliata—the stock commonly used—make a very rapid growth, and materially hinder the growth of young Satsuma trees especially.

**Frost Protection:** The only method used for protecting the Satsuma trees in this section against cold is mounding. Soil is mounded up twelve inches high around the lower part of the tree. In case of a freeze severe enough to kill the top of the tree, the part above the bud union protected by the soil would furnish new growth the next season. This mounding should be done to the young trees as soon as they are set. Remove the mounds in the spring of each year. Trees of bearing age are apparently much more resistant to frost injury than younger trees, other conditions being equal.

As discussed under selection of the grove site, good air drainage is of great importance in the prevention of frost injury. In addition good judgment must be used as to cultivation, fertilizing, and spraying for maintaining vigorous trees, with well matured wood to carry through the winter season.

**PROPAGATION**

The Satsuma orange is generally propagated by budding, Citrus Trifoliata being the stock used. Citrus Trifoliata is a deciduous thorny bush or tree which sheds its leaves late in winter, being different in this respect to most citrus plants which are evergreen. The small fruits are worthless for eating purposes. They are filled with seeds, which should be left in the fruit until time to plant in the field in November, December or January. The method followed here at Poplarville was as follows: The seed were planted in rows 3½ feet apart, the seed being dropped 3 to 4 inches apart in the rows, the rows having been well fertilized, and were given good clean cultivation throughout the season. During the dormant period, at the end of the first season the seedlings were transplanted to nursery rows 3½ feet apart, spaced 12 to 15 inches apart in the rows, giving approximately 10,000 Citrus Trifoliata seedlings to the acre. These were budded during May and June of the following spring and buds forced into growth as soon as they caught—about 2 to 3 weeks after budding. This forcing is done by cutting the tops off about 2 inches above the buds. A one to two foot tree is possible by the following fall, large enough for orchard planting. However, these small trees can be held in the nursery another year if desired. The seedlings on which the buds fail to catch in the spring work may be budded again in August or September, using buds from the same season’s growth.

Some nurserymen plant the Citrus Trifoliata seed in beds, growing a small seedling by fall, which has to be transplanted and grown another season before budding. While the method described above requires more land the first year, time is gained by being able to bud the stock about a year ahead of the second method. Transplanting of seedlings once before budding is desirable, as a better root system is established.

Budwood is cut in December or January previous to the time for budding. Branches of the past season’s growth are cut, leaves trimmed off and the bud sticks then stored in a cool shady place in moist sand or moss. Budwood should of course be selected from healthy vigorous trees. In addition, judging from the marked success attained in California, special attention
should be paid in selecting the propagating wood from prolific trees which bear a high quality fruit. Even on just one limb of a tree superior fruits are often borne, and buds taken from such limbs tend to reproduce the desired characteristics.

The process of budding is quite simple. A shield shaped piece is cut from the bud stick containing the bud and a piece of leaf stalk. This is inserted in a T-shaped incision in the seedling stock 1 inch or 2 inches above the ground, and securely wrapped with raffia or a strip of waxed cloth.

If the Citrus Trifoliata seed is kept in the fruits until planting time a good germination should secured, giving 1000 to 1500 plants per pound of seed.

HARVESTING AND MARKETING

Harvesting. As with all fruits the Satsuma orange must be handled carefully. Any operations which would result in punctures or bruises of the fruit must be avoided. The fruits should not be pulled from the tree, because this method followed by careless pickers would result in breaking the skin at the stem end. Special orange clippers are obtainable for cutting the fruit from the tree, and are so constructed that the stem is cut close to the fruit, thereby leaving no projecting stem for puncturing other fruits in the boxes. Picking boxes for use in the groves should be constructed with high ends, so that in stacking the boxes no fruit will be bruised.

While the period of harvesting may extend over one or two months if desired, it is possible to harvest the bulk of the fruit at one picking. The full sugar content of the Satsuma is developed early in the ripening stage so that the quality of the fruit is not impaired if harvested before it is dead ripe.

Marketing. While the first stage in marketing a fruit crop is generally considered to be giving the fruit the proper pack, it should be emphasized that the preparation of the fruit for market should start in the grove with proper cultivation, fertilizing, spraying, pruning, for the production of clean, bright fruit of desirable size. The production of a superior quality fruit obviously facilitates its marketing.

Mississippi Satsuma growers are fortunate in being able to enlist the services of the Gulf Coast Citrus Exchange, an established marketing organization originated by the Citrus growers at Gulfport, Mississippi, in 1910, and now headed by Dr. O. F. E. Winberg of Silverhill, Alabama. This exchange supervises the construction and equipment of cooperative packing houses, and the cooperative marketing of fruit from the entire Satsuma belt. In addition the exchange advises on cultural methods, such as fertilizing and spraying, and mixes its own fertilizers and spray materials for sale to the members of the exchange at cost. At present there is only one branch of the Gulf Coast Citrus Exchange in Mississippi—the Harrison County Citrus Growers Association which has its packing house at Lyman on the G. & S. I. Railroad. Another packing house is being built at Long Beach. The oranges from these districts are handled by the packing house where they are properly graded, wrapped and packed under expert supervision. The central office of the exchange at Mobile then directs the distributing of
the fruit to the best markets. One of the first cars from the packing house at Lyman in the fall of 1922 went to Montreal, Canada in good condition. The Satsuma box is 12 inches by 26 inches by 6 inches. The number of oranges packed in this box ranges from 96 to 288, the medium sizes being in better demand on the market.

Modern Packing House at Lyman, Miss.

YIELDS, COSTS, AND PROFITS

Because of the newness of the Satsuma industry, information on these points is quite limited. As in any business, some individuals make a very flattering success under favorable conditions and good management, while others make only fair profits. Some neglected groves, or groves on improper sites, are operated at an actual loss. If the grove is properly situated, and given good management, the Satsuma will compare favorably with any other fruit industry in the United States, present indications being that it will prove even more profitable. The trees are very prolific, the fruit is of superior quality and the first orange on the market, while the territory adapted to successful culture is quite limited. In well managed bearing groves which have come under observation there has been a crop each year, and this is the testimony of all growers consulted where all cultural conditions have been favorable. A national authority on Citrus fruits made the statement recently that the Gulf Coast Citrus industry was organized and is being operated on a higher plane than any other citrus section in the United States, and that the Satsuma is destined to be a gold mine to the growers in the Gulf Coast section.
The following yields and returns are given as an indication of what the Satsuma is doing:

In 1922, 6500 trees in their fourth season yielded 1975 boxes of marketable fruit. This is practically one-third box per tree, and on the basis of 70 trees per acre (25 feet by 25 feet) would be equivalent to 21 boxes per acre.

One 4½ acre grove gave a return of $3500 with the average price of $3 per box. This is equivalent to a yield of 259 boxes per acre, and a gross income of $777 per acre.

Six 8-year old trees on a farm near Logtown, Miss., averaged 3000 oranges each, equivalent to 16 boxes per tree. (Basis of 180 average per box.)

In one grove of 300 trees, the crop for the third and fourth seasons after planting paid for the grove, according to the owner.

An 18-acre grove yielded 4000 boxes that sold for $3 to $5 each.

Ten acres gave a return of $10,000 and the same grower on a small number of trees produced a yield up to $3000 per acre.

534 trees in the 11th year gave a return of over $9000.

It is not intended to convey the idea that each and every grower can expect returns such as given above, though a visit to bearing groves which have been given good care will convince any one that the Satsuma is very prolific. At first glance, the last figures given, $9000 return from 534 trees in their 11th year, may look unreasonable. However, 6 boxes of oranges per tree at $2.80 per box would give this return. Under good conditions, 6 boxes for 11-year old trees is quite possible.

The following is quoted from a letter from a Mississippi grower who has made a good success with Satsumas:

"Trees will cost about 50 cents each, fertilizer five cents per tree for the first year, labor for setting 15 cents per tree. ** ** At ten years the tree should get 30 pounds of fertilizer each and produce 8 or 10 boxes to the tree. They will show a profit, or should, when three years old. It will cost $1.05 to pick, pack, and put in dealer's hands. Spraying and cultivation are essential ** Price in 1921 ranged from $2.50 per box, some bringing as high as $4.00."

The following statements regarding costs of Citrus fruit production in California, are taken from the February, 1923 issue of the American Fruit Growers Magazine:

"Orchard costs in the production of oranges and lemons in Southern California are probably greater per acre of bearing orchard than are the costs of any other commercially grown fruit in the United States. During the past ten years growers have spent each year an average of $185.00 per acre in the production of oranges, and $240.00 in the production of lemons, exclusive of the cost of picking the fruit."

In contrast to these figures, note the following statement given on page 43, Farmers' Bulletin 1122, (""Citrus Fruit Growing in the Gulf States").

"The annual cost of maintaining a grove in Florida after it reaches bearing age averages from $75 to $150 per acre. When all or most of the labor is performed by the grove owner the cash expenditure of starting and maintaining a grove may be reduced a third or even more."
It should be said that the cost of maintaining bearing groves of Satsumas would very likely be less than for the larger trees of oranges and grapefruit in Florida.

WILL SATSUMA ORANGE PLANTING BE OVERDONE?

A similar question has been asked concerning most of the commercial fruits now grown in the United States. It was asked repeatedly during past booms in apple planting. In 1919, there were nearly 2 1/2 million acres of bearing apple trees in the United States, and the total production in 1920 was 223,677,000 bushels. (U. S. D. A. Year Book, 1921). And we are still paying forty to ninety cents per dozen for apples. The packing of high-grade fruit, good business methods in distribution, with an increased population, took care of the greatly increased production.

It does not seem possible that there can be an over-production of Satsuma Oranges, especially when the following points are considered:

1. The extent of territory in the United States adapted to commercial production is quite limited. Future plantings will be largely confined to the coastal region of Mississippi, Alabama, Louisiana, and Northwest Florida.

2. The Satsuma is the first orange on the market.

3. The superior quality of the fruit will stimulate a large and increasing demand.

At present only a few of the consuming markets in the United States are familiar with this fruit. The production centers are within easy reach of the largest consuming centers of the United States, and with the distributing service of the Gulf Coast Citrus Exchange already in operation, it seems inevitable that there will be an unlimited, profitable demand for this high class dessert fruit at all times in the future.

Prospective investors are urged to visit this section during harvesting season, October and November, to make independent observations concerning this important Horticultural industry.

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