

## SUBTROPICAL FRUITS FOR CALIFORNIA

**W. B. Storey**

*Associate Horticulturist, University of California at Riverside.*

*(An address given at the annual meeting of the California Avocado Society, June 4, 1955)*

There are in the world more than two hundred widely disseminated species of tropical and subtropical plants which bear edible or otherwise useful fruits. Doubtless most of these species have been introduced into California at some time in the past. Many failed for various reasons to become established in the State, but a large number, possibly as many as one hundred, are now well established. A select few, like the orange, the lemon, the olive, the date, the fig, and the avocado, are now important fruit crops of the State, with many thousands of acres given to their culture. Several, like the oriental persimmon, the cherimoya, the loquat, and the passion fruit, are, or have at some time been, cultivated as commercial crops on a small scale for limited markets. The great majority, however, are still to be found only as single specimens or a few plants in home gardens, botanical gardens, and public parks.

Tropical and subtropical fruits have been under observation by many persons and for many years in California. Their uses, flowering and fruiting behaviors, climatic tolerances, and adaptation to soil types are generally well known to horticulturists, and the information is readily available to the layman who might want to try growing some of them. A real enigma is what makes a fruit "click". One wonders why the American consumer remains indifferent to fruits which enjoy great popularity elsewhere, as for example, the oriental persimmon and the loquat in the Orient, the passion fruit in Australia, the tree tomato in New Zealand, and the guava in many parts of the world.

A recurring question nowadays is, "What fruits, if any, might be developed into economic orchard crops?" It is continually being asked by avocado growers who are mindful of the threat of root rot to avocado production in certain areas and by persons who find themselves with tracts of land unsuitable for the production of avocados, citrus fruits, or other crops with established markets. The question is difficult to answer with any feeling of confidence, for we have already seen how a number of fruits which seemed to be promising as economic crops failed to measure up to their promise for one reason or another.

The need, of course, is for a few "naturals"; that is, crops which are well adapted to the areas under consideration, are readily marketable in fresh or processed form, (or for which markets can be developed through consumer education and promotion as was done with the avocado) and which can be produced with reasonable profit to the growers. In any consideration of such crops, the list soon dwindles down to those things which have already been exploited with indifferent success, and to a few which are

relatively untried. Among the latter are the macadamia nut, the lychee, and the carob, and it is to them that I shall devote the remainder of this discussion.

The macadamia nut ranks high among the confectionary nuts of the world, according to the opinion of experts in the field of nut marketing who are supposed to know such things. It is still only slightly known in California, and virtually unknown elsewhere in the United States.

In recent years, the macadamia has been attracting much attention as a potential new crop for southern California, especially for areas where avocado production has been declining as a result of the invasion of root rot. Its possibilities in this regard warrant further investigation.

Development of the macadamia from an obscure Australian forest tree into an increasingly important commercial orchard crop tree is almost entirely a Hawaiian horticultural accomplishment. At present, commercial production is still confined largely to Hawaii, where about 1,000,000 pounds of nuts (250,000 pounds of kernels) were produced and vacuum packed in glass jars last year. Of this amount, probably no more than 20 percent were shipped out of the Islands into the United States, where the nut sells as a luxury item at a premium price. Present production still comes mostly from about 700 acres of seedling trees which were planted prior to 1940. Since 1940, and particularly since 1948, an additional 1800 acres have been planted. The new plantings consist almost entirely of grafted trees of high-producing varieties. When these come into full production, one can expect Hawaiian output to be four or five times what it is now, probably with a large percentage being shipped into the States. This is bound to have an effect on the economics of macadamia production in California.

However, a dealer specializing in nuts with retail outlets in a number of large cities asserts that he could sell 50,000 pounds of kernels a year, if he could get them, and if the retail price could be pegged at \$2.50 a pound or less. As the public became acquainted with them, sales could rise to 100,000 pounds or more a year. He estimates his present sales of all nuts at about one-twentieth of the total retail sales in the United States, which would indicate a potential market for 2,000,000 pounds of kernels yearly. His figures do not take into account a number of large Western candy-making concerns which have shown interest in a source of supply of macadamia nuts. It would seem, therefore, that there is a large potential market which, at present and for a long time to come, cannot be adequately supplied by any source.

The macadamia is adapted to the climatic regions of southern California where avocados are grown commercially. This seems pretty well demonstrated by the hundreds of trees of various ages which have been located, mostly by the Subtropical Fruit Varieties Committee of this society and by Dr. C. A. Schroeder, all the way from Santa Barbara to the Mexican border. Many of these trees have come through freezes with little injury where other subtropicals have been severely damaged, if not killed. Cold hardiness appears to be a characteristic of the individual, however, for this past winter saw many well-established seedling trees killed outright by sharp frosts where closely adjacent seedlings in the same planting came through unscathed. This is a point deserving serious consideration in any macadamia evaluation and selection program.

One point in the macadamia's favor as a replacement crop is its high degree of

resistance, if not of complete immunity, to avocado root rot. This has been demonstrated experimentally by Dr. George A. Zentmyer, of the Department of Plant Pathology at Riverside, and in practice by growers who are raising thrifty trees in areas where avocado trees have been killed by root rot.

There are still many imponderables in macadamia culture in California which need not be dwelt on here. However, it might be well to consider production briefly, since it is production and profitable returns which keep the grower in business.

Production is largely a matter of good, high-yielding varieties coupled with good culture. Although the best Hawaiian varieties are available, their worth under California conditions still remains to be seen. Avocado growers are well aware of the fact that varietal performance in avocados varies greatly under even slight differences in climate. We should anticipate an analogous situation in macadamia. We must continue to search for productive trees among seedlings bearing in California while the Hawaiian varieties and accessions from Australia are being tested.

I have seen and heard of trees in the State which bear crops of 150 pounds or more of nuts in the shell. Taking a good, conservative figure like 100 pounds per tree in orchard planting, and 70 trees to the acre, we arrive at the figure of 7,000 pounds per acre. At the current price of about 20 cents a pound, f.o.b. Honolulu, this figures out to a gross return of \$1400 an acre. It probably will take 10 years from planting to reach this figure. Where it goes from there will depend on how high yielding the trees may actually be, how many trees can be squeezed into an acre, and what the local price for nuts will be at the time.

Whatever one's feelings about the future of the macadamia as an economic crop for California may be, it is not something that can be brushed aside. Interest in it runs high, and already 2,000-3,000 trees have been planted in southern California in plantings which range from one or a few trees to two or three acres. More and more, persons are asking for information on the macadamia with the thought of planting if the outlook is favorable. It is to help those who have planted and those who contemplate planting that an intensive, objective study must be made to determine the real potentiality of the macadamia as a California crop.

The lychee offers a real challenge to the experimental horticulturist in southern California. The consensus of opinion among horticulturists seems to be that neither the climate nor the soils are suitable for its culture. Nevertheless, a fine specimen grew for many years in the period from 1901 to 1919 at Santa Barbara on the grounds of a residence at the end of East Sola Street. In 1916, it was reported to be about 10 feet tall and 15 feet in spread, and was said to bear good crops. At the time, it was the only known bearing lychee tree in the United States. It was well known to Drs. F. Franceschi and Peter Riddell, botanists who resided in Santa Barbara. It was visited on occasion by Drs. David Fair-child, Peter Bisset, and Wilson Popenoe of the U.S. Department of Agriculture Bureau of Plant Industry, who were trying to establish the lychee in Florida. I find no written record of it later than 1919. Neither it nor the old house near which it stood now exists.

Near Bostonia, in San Diego County, there is a planting of lychee trees perhaps 15 years old. When I saw them about 2 years ago, they were in full bloom. I have been

told that they produce good crops of fruit annually.

There is a tree on the grounds of the Citrus Experiment Station at Riverside which was planted in 1927. It is not large now, but the size of the trunk indicates that it probably was larger at one time. It is quite thrifty in growth. Last year it produced a light crop of fruit. It is in bloom now, but the crop of fruit will again be light if one sets.

It has long been thought that the lychee would grow only in acid soils. Good growth and satisfactory crops have been obtained in Florida, however, on basic soils with pH values ranging from 7.5 to 8.1.

Just how important high relative humidity of the air may be to fruit setting and development of the lychee is a moot question. We have seen that fruit can be set in some areas of southern California where relative humidity may be quite low during the late spring and summer, the season of setting. Satisfactory fruit setting is reported from semi-arid regions of India and from Rehovoth, Israel, where climatic conditions are likened to those of southern California.

Cold tolerance is said to be about that of oranges and greater than that of avocados. As with other subtropical fruits, cold tolerance may be largely a question of how low a temperature a given variety can stand for how long under certain conditions of soil and air moisture. Without reference to varieties, there are reports of damage to lychees in Florida and South Africa at temperatures around 27 degrees Fahrenheit, and reports of little or no damage at Saharanpur, India, at 11 degrees.

There are numerous varieties of the lychee, many of which deserve introduction and testing in California. Among them may be one or more which can cope with the conditions which seem heretofore to have militated against culture of this fruit in the State.

The lychee is a fruit which almost everyone finds delicious the first time he is exposed to it, and for which he needs not acquire a taste. It is little known as a fresh fruit in California, although many persons have eaten "Chinese lychee nuts", which is the dried form bearing the same relation to the fresh fruit as a raisin bears to a grape. It is rapidly assuming prominence in Florida, where in recent years, upward of 400 acres have been planted.

A well-grown lychee tree under conditions favorable for fruiting is a highly productive thing. I have seen 7 and 8-year-old trees in Hawaii bear 100 pounds of fruit, and 15 to 20-year-old trees with 300 pounds and more. Comparable figures are reported from Florida. At the going rate of \$1.00 a pound to the grower in Hawaii and Florida, hypothetical returns approach a fantastic figure when extrapolated to the acre basis. The big catch is stated in the first sentence of this paragraph, but bears reiteration: The trees must be well grown under conditions favorable for fruiting.

Whether trees can be well grown, whether conditions are favorable for fruiting, and what varieties, if any, are likely to succeed are things which must be determined before one is ready to say that the lychee is a coming crop for California. Until that day comes, I should hope that no one will be unduly carried away by any enthusiasm which this discussion of the lychee might generate.

The third subject of this discussion, the carob, seems to have been a victim of

circumstances insofar as a real appraisal of its possibilities as an economic crop in California is concerned. Twenty-five years ago, there was a surge of interest in carob culture. This was largely promoted by real estate subdividers whose only real interest was the sale of unirrigated lands. All of the plantings failed, for reasons that are now pretty well known, and carob culture acquired an ill repute from which it is only now showing signs of recovery.

The carob thrives in southern California, as attested by its wide use in landscape, shade, and avenue plantings. Virtually all of the trees planted in the past, however, whether for the uses just mentioned or in earlier abortive commercial plantings, have been seedlings with poor or indifferent pod quality. To succeed as an economic crop, good varieties are needed, just as they are needed if one is to stay in business producing avocados, or oranges, or grapes, or any other fruit. Furthermore, studies are needed on the good varieties in those climatic areas where atmospheric humidity, rainfall, and other factors would seem best suited to the production of high quality pods.

Dr. J. Eliot Coit, who is my source of information on the carob, states that under suitable dry farming conditions the carob tree should begin to bear the fifth year from budding and produce about 5 pounds of pods. By the twelfth year, the trees should bear 100 pounds of pods, and by the twenty-fifth year about 250 pounds. With trees planted 35 feet apart, or 35 to the acre, the expected yield would be 8,750 pounds, much more than can be counted on from barley or hay under similar conditions. It can be planted on lands which, because of size, location, or topography, cannot be utilized for hay or cereal crops, or which soil type, water limitations, and diseases render unsuitable for other fruit crops of the region.

The carob pod has a number of uses. It has been found to be a highly satisfactory livestock feed. It is attracting considerable interest as human food, particularly when prepared in various processed forms.

The seeds are the source of carob gum (*tragasol*) which has numerous uses. A few of these are: paper size; printing pastes; laxatives and other pharmaceuticals; match head binder; metal polishes, etc.

Carob pods are imported into the United States from various Mediterranean countries. In 1948, about a million pounds were imported. Likewise, carob gum is imported, the amount in 1948 being over six and one-half million pounds, valued at \$1,750,000.

A tree which thrives like the carob in California, yet whose product must be imported, deserves further looking into, especially if it can be produced on lands which presently are nonproductive or of limited productivity.

A reappraisal of carob culture is presently under way. The moving spirits are Dr. Walter Rittenhouse and Dr. J. Eliot Coit. They have established an experimental orchard near Vista, which contains improved varieties from Tunisia, Greece, Cyprus, and Italy, together with promising selections made from the thousands of seedlings scattered about the State. This orchard should provide a wealth of information on carob varieties, culture, production, and economics, and its progress will be followed with interest.

I selected the macadamia, the lychee, and the carob out of the dozens of subtropical fruits which I might have discussed because two of them, the macadamia and the

carob, seem to come closest to answering the question as to what fruits have the best prospect of being developed into commercial orchard crops. My feeling about the lychee is that its possibilities have never been fully explored, and we ought to give it a fair chance to show what it can do.

I hope no one will construe this discussion as prophesy. There are many whims and vagaries of humans, of nature, and of economics, which spell the difference between success and failure. The only sane course is to study, to experiment, and to analyze, until the facts are in. Faith and enthusiasm are fine assets, but facts are needed for profitable enterprise.