

ourselves little good with the present hodgepodge. Much more emphasis should be placed upon quality than has been evidenced in many recent plantings. You may say "Why not raise Mulgoba, Borsha and Paheri?" Scientists have removed the "bugs" from so many agricultural products, why can't they make Mulgoba bear lots of firm fruit, Borsha put on larger, cleaner crops and Paheri produce prettier fruit on sturdier trees? Well, so far they have not succeeded in making Haden behave and they have worked on that problem for a long time.

AVOCADO GROWING IN DADE COUNTY

Wm. H. Krome¹

THE AREA IN FLORIDA in which avocados are grown commercially may be divided into two sections: Dade County, at the southern tip of the mainland; and the counties extending north from Dade as far as temperature minimums permit commercial cultivation (this limit runs roughly from Cape Cañaveral on the east coast to Tampa on the west coast). About four-fifths of the production is in the former section. My own grove operations are in Dade County, and my remarks are meant to apply only to that section.

Avocado groves in Dade County range in size from an acre or less to over 100 acres. Over 90% of the commercial plantings are of improved, budded varieties, the remainder being seedlings. There are from 70 to 85 trees per acre, as a rule; according to the Dade County Agent's office the average is 78 trees per acre. The plantings are for the most part solid avocados, but inter-planting with limes or other fruit trees is not uncommon. Many groves are operated by resident owners, but quite a few belong to non-residents, and most of these are cared for by professional caretaking organizations.

¹ A paper presented, March 8, 1954, at a hearing preliminary to adoption of a Federal Marketing Agreement for Avocados.

The avocado does not bear heavily when young, and it takes five to eight or more years to develop a grove to the point where it begins to pay its way. Thus a mature grove represents a sizeable investment. Figuring very roughly, I should say that at present price and wage scales the cost of bringing a grove into profitable production now would be in the neighborhood of \$ 1200.00 an acre. Maintenance costs thereafter will vary, of course, with the amount of care given the grove, and with the efficiency of the caretaker. Proper care is likely to run about \$ 300.00 an acre per year. As size and production of the trees increase, the costs may go higher. The best information I know of on this subject is found in a publication by the Dade County Agricultural Agent's Office entitled, "Costs and Returns on Avocados in Dade County, Florida, Seasons 1938-1950, incl.", with a supplementary table bringing some of the data through the season 1953. I suggest that it be referred to when detailed cost information is desired.

ACREAGE

The part of Dade County where avocados are raised commercially consists of a ridge of rocky land extending southwest from Miami to a point a few miles below Homestead. It is confined to land on which water does not stand for more than a few hours during maximum flood conditions, and is consequently relatively limited in extent. This type of land is in increasing demand for residential purposes, as the population of the Miami area grows. It is also regarded as the best land for limes and mangos. With this competition for land use, the amount available for avocados is being reduced, and incidentally the price of raw land and the taxes thereon, are increasing to such a point that areas close to towns and residential developments are already too expensive for agricultural use. The amount of land in avocado groves will doubtless increase; I might guess that it could eventually double its present extent, but expansion will certainly be limited by the factors I have mentioned. I present herewith the acreages of bearing avocados (including all over 3 years of age), as well as the production and crop value, in Dade County for the past several years, as recorded by the local County Agent's Office.

Year	Acreage	Bushels (total)	Bushels (avg. per acre)	Av. Price	Value
1948	2,969	156,000	52.5	\$3.75	\$ 585,000
1950	3,912	220,000	56.2	3.35	737,000
1951	6,197	260,000	42.0	2.65	689,000
1952	7,498	348,000	46.4	3.05	1,061,400
1953	8,400(1)	424,000	50.4		
1954	9,000(1)	470,000(2)	42.2		

Note (1): Estimated.

Note (2): Includes 45,000 bu. of N° 3 grade not marketed.

Once well established, avocado trees can stand almost any hardship except flooding. Most of the original groves on well-drained land in this area remain in production today. A few fine groves have been cut up into small parcels and developed as residential sites, and more will suffer this fate in the future, but it seems reasonable to suppose that new plantings will considerably exceed the acreage lost to residential development. Most present planting is on fairly high land, so that we can anticipate little loss from flooding. All in all, I believe that the figure of 9,000 acres may be regarded as the amount of potential bearing groves in the near future, with probably a gradual increase in acreage as time goes on.

PRODUCTION

The chief factors influencing production are age, variety, care and weather.

AGE

An avocado does not produce commercially profitable crops until it is 5 to 8 years old. From then on, barring mishaps, its production should increase until it is at least twenty years old. Taken in the aggregate, production probably holds fairly steady after twenty years of age. The factors which reduce it, hurricane damage and disease, should

be offset by replacement of poor trees such as is normal in good grove care, and by the actual increase in production of a fair portion of the trees which escape major damage.

The avocado is naturally a very long-lived tree, and we have no evidence that production ever declines due to age alone. One of the largest and most prolific trees I ever saw was a specimen in Central America which was known to be over 200 years old, while here at Homestead the best block of avocados I have is also the oldest, being at present 46 years old.

VARIETY

Avocados in Dade County fall into three general groups: those of the West Indian race, those of the Guatemalan race, and hybrids between the two races.

The West Indian type of fruit is characteristically early in season, maturing in summer or early fall; the skin is usually smooth and leathery, and the oil content of the flesh is relatively low. The tree is very susceptible to cold injury. Fuchs, Pollock, Trapp and Waldin are examples of West Indian varieties.

Fruit of the Guatemalan race tends to have a harder, frequently rough skin; it matures later than the usual West Indian variety, mainly in winter, and its oil content is higher than that of the West Indians. The tree is considerably hardier to cold than the West Indian types. Taylor is an example of the Guatemalan race.

The hybrids combine the characters of the two races in both tree and fruit. Their season comes between that of the West Indians and the Guatemalans, although there is some overlapping at both ends. Many of the most satisfactory commercial varieties are of this type, due primarily to the vigor and prolificness of the trees. This group includes all the Booth varieties and the Hickson. The most popular variety, Lula, is also a hybrid, but it is unique in that it is between the Guatemalan and the Mexican races. We have no other commercial variety with this parentage.

The characteristics of size, shape, color, palatability and prolificness vary widely in all three groups, with no group having a monopoly of either good or bad qualities. None of the varieties we have now is entirely satisfactory in

all respects, either. The newer varieties are a big improvement over most of the older ones which they are replacing, but as time goes on still better varieties will probably be developed to replace those we now have.

The difference in yield between varieties must be at least in the order of 1 to 3, from the lightest to the heaviest bearing of the common varieties. As an example of this I submit the average yields per tree of different varieties in a mature grove for the past 3 years:

Booth 8, 6 bushels; Lula, 5 bushels; Waldin, 2½ bushels; Collinson, 2½ bushels; Fuchs, 1½ bushels.

All these trees are about 25 years old, and except for some of the Waldins are in uniformly excellent condition, well above the average mature tree in both size and condition. Making allowance for this, I believe that a mature tree of a heavy bearing variety such as Booth 8 or Lula should yield an average of at least three bushels per year, while I doubt whether average yield of a variety such as Fuchs will be much over one bushel.

Taking three bushels per year as "Heavy", two bushels as "Medium", and one bushel as "Light", I would class the more common varieties as follows:

Heavy: Booth 7, Booth 8, Lula, and possibly Booth 5.

Medium: Hickson, Booth 1, Booth 3, Waldin and Trapp.

Light: Fuchs, Pollock, Collinson and Taylor.

I can show exceptions to these classifications from my own production records, and the classification probably is different in the central section of the state. The fact, however, that the average yield per acre on groves averaging about twenty years of age has ranged from 107 to 171 bushels from 1950 through 1953 indicates that general production is much lighter per tree than either the figures I cited previously for a single grove, or other isolated instances which may be adduced, might lead one to believe.

In this connection, it should be brought out that avocados may be very successfully top-worked to different varieties. The process is fairly costly in the case of large trees, but the resulting top grows excellently and only two or three crops are lost before the new top is again in com-

mercial production. When the original tree was a seedling or an undesirable variety, as is usually the case, the value of the crops lost is very small and the heavy subsequent yields more than make up for the cost in a few years. It is reasonable to believe that many of the seedlings and the varieties which are undesirable either because of light production or poor marketing quality will be changed by topworking to better varieties. This will have the dual effect of increasing production and of reducing the quantity of the poorer types of fruit in the market.

CARE

It seems obvious that the production of a grove will reflect in some measure the care it receives. However, this does not seem to be as important a factor with avocados as it is with some other tree crops, such as limes.

Avocados here require heavy fertilization, and production reflects this one item of care more than any other. The other normal cultural operations include spraying, mowing or dragging, pruning and irrigation. Practices vary considerably, but as long as they receive enough fertilizer the trees seem to produce under any system of caretaking.

Spraying may be considered an exception to this, but unless insects or disease are allowed to get completely out of hand, the chief effect of spraying is on the quality of the fruit, rather than on the quantity. The avocado fruit is subject to two serious fungus diseases, scab and black spot, and a third, less important one, *Cercospora* spot. From one to four fungicidal sprays a year are necessary to control these diseases, and if the sprays are not applied, or are improperly applied, the fruit which is affected is liable to be completely ruined as far as shipping is concerned. This type of fruit causes one of our biggest marketing difficulties. Even though it may be worthless, a grower hates to throw fruit away if there is a possibility of getting any money at all for it. And in truth unless everybody were prevented from offering such fruit for sale it would be pointless for an individual to keep his own culls off the market.

WEATHER

Yield of avocados, as with all other agricultural products, is affected by a number of weather factors. Some of those affecting avocados may be regarded as normal, while some must be considered peculiar to this area.

Freezes in winter, flooding in the summer or fall, excessive drought in either winter or summer, rainy weather during the blooming season, all reduce production from time to time, and the total hazard involved probably is about the same as with tree crops in other places.

The biggest weather hazard to avocados here, however, is the hurricanes which sometimes come in the fall. Damage from these great storms is quite common, and of course its extent depends upon the severity of the storm. About one year in three we lose some of our crop because of hurricanes. Ordinarily damage is confined to crop loss and a general beating up of the trees, from which they quickly recover. Once in a while, however, we have a storm of such magnitude that the destruction requires several years to repair, and during the period of rehabilitation total production is likely to be greatly reduced. Old groves are more severely injured by hurricanes than are young groves, partly because the stouter trees do not yield as gracefully to the wind, and partly because many of the old trees have been permanently weakened by previous storms. The worst of these storms occurred in 1926 and 1945. In spite of extensive rehabilitation, production on my own groves is still only about 85% of what it was prior to 1945.

We are now attempting to reduce this type of damage by cutting the tops out of the trees when they grow too tall. This doubtless reduces the crop to some extent, but the lower headed trees should not be so seriously damaged by the hurricanes. This practice is by no means universal, and it has not been used long enough for us to know how successful it will be.

In any event, the threat of heavy destruction to such valuable property as an avocado grove is a very special factor, and should not be overlooked in any general consideration of the industry.

HARVESTING

The actual harvesting operation is standardized, and consists of picking the fruit either by clipping the stems or by pulling the fruit from the stems, and transporting them to the packing house in one-bushel wooden boxes. There is evidence that fruit which has been clipped from the stem keeps better than fruit which has been pulled. Weight of a bushel of avocados, as placed in the box in the field, varies from 45 to almost 55 pounds, depending largely upon the size of the fruit (a box of small fruit weighs more than a box of larger ones).

The fruit is easily damaged by rough handling. A common practice of filling a box too full and then crashing the next box down on top of it causes a lot of absolutely needless injury, which is sometimes difficult to detect until the fruit softens. Mistreatment of fruit is not confined to handling in the field, but may also occur during some packing house operations.

SEASON

The harvesting season opens in late June or early July and continues into the following January. Some varieties may be held as late as March and April, but the loss from cold, disease, theft and normal droppage is so great that this is not done to any important extent. The peak harvest is from the middle of September to about December 20th.

Unlike California, which has varieties which mature over a long period of time, and therefore needs only a few standard varieties to extend over its entire season, Florida varieties have relatively short shipping seasons, so we have to use a number of varieties which mature at different times in order to have a constant supply over the six-month marketing period. Generally speaking, the earliest varieties have the shortest shipping periods and the latest have the longest. Fuchs, one of the very earliest, does not carry well, and the grower is consequently under some compulsion to pick it before it is properly mature in order to be able to get it to market without spoiling. On the other hand, Lula, one of the latest varieties, can be marketed over a period of 8 to 12 weeks. The marketing period for most of the

mid-season varieties does not usually run over four to six weeks for any one variety. This period is usually about the same every year. It may vary somewhat according to weather conditions, time and length of blooming period, and the fertilizer practices used. Sometimes a variety will have two main periods of bloom as much as a month apart. The ripening period of fruit set from such a double bloom will usually spread over a longer period than it would otherwise. There is a limit to this lengthening of the ripening period, however, just as there is to the time maturity may be hastened or delayed by environmental factors. It is seldom over two weeks earlier or later even in extreme instances.

According to Florida State Agricultural Extension Service Bulletin N° 141, "Avocado Production in Florida", the maturity periods for the most commonly planted varieties are as follows:

Fuchs	Late June to August 1
Pollock	July 15 to September 1
Trapp	September 1 to October 15
Waldin	September 15 to November 1
Booth 8	October 15 to December 1
Booth 7	November 1 to December 15
Collinson	November 1 to December 15
Hickson	November 15 to December 15
Lula	October 15 to January 1
Booth 5	December
Booth 1	December 1 to January 15
Taylor	December 1 to January 15

The maturity period of most varieties of the West Indian race is about the same as for Trapp and Waldin, although the West Indian seedlings are sometimes picked a little earlier. There are many hybrids between the West Indian race and the Guatemalan race which mature at about the same time as the Booth 8's and Booth 7's. The Subtropical Experiment Station at Homestead has done extensive work in determining the maturity periods of many of these varieties.

We growers have no really reliable method of determining the earliest date our fruit is ready to pick. We have several guides, all of them imperfect. First of all, as I have said, each variety has a fairly regular season, and most growers know when the seasons occur. An experienced

grower can also judge maturity of a variety he is familiar with to some degree by size and external appearance, that is about the only guide he has when he is actually out picking the fruit. It is our common practice, too, to pick a few fruit about the time we have some reason to believe they will ripen, and set them aside for observation. The chief objection to this is the delay in getting the information.

The most common laboratory method for determining maturity is measurement of the oil content of the fruit, although some other methods have been tried. The difficulty of determining the oil content accurately and rapidly by ordinary field or packing house methods, and the extreme variation in the oil content of our many varieties, have until now kept this method from being used except in research work.

Ordinarily it might be presumed that the fruit would be picked some time during the period of proper maturity, and that the only other factors influencing time of picking would be the condition of the market within that period, and the grower's ability to get his work done. These are the most important factors, certainly, but they are not the only ones. Sometimes a grower will hold his fruit longer than its normal period in the hope that better prices will more than offset losses from droppage, etc., while on the other hand fruit is some times picked earlier than its normal period of maturity for any of several reasons. For one thing, a slightly immature avocado ships and keeps better, and inasmuch as the fruits highly perishable at best, the handlers in distant markets who are not well acquainted with the proper periods of maturity for each variety, frequently insist on being supplied with a certain variety before it is properly mature, as they then have a longer time to dispose of it before it spoils.

In the case of large-fruited varieties, a higher return per bushel may sometimes be secured by picking the fruit when they are still of smaller, more desirable size, and this also may require that they be picked too soon.

There is also the matter of relieving limbs to prevent them from breaking. Thinning of young fruit is not often practiced here, and it commonly happens that limbs of heavily loaded trees break off as the fruit sizes up. When this occurs a portion of the crop is sometimes picked to

relieve the limbs, and this again is likely to be immature fruit. If it is too utterly green it may be thrown on the ground, but if it lacks only a little of being properly mature an attempt may be made to sell it.

Then too, there is always the temptation to pick the crop when prices are high, particularly if the grower believes the price will drop later. There is a saying that "nothing hastens maturity like high prices". I might add that very few things will eliminate high prices as effectively as a flood of immature fruit.

Another cause for picking fruit too early is the threat of storms. Tropical hurricanes occur somewhere in the Atlantic and Caribbean areas every fall, averaging about eight a year. While most of them never come near Dade County, we usually spend a few days each fall wondering whether a storm headed in the general direction of the Florida coast will be a "direct hit" or wreak its destruction on somebody else. Many growers regard loss by storms as one of the inevitable gambles in the industry, and refuse to pick any more than they feel the market can absorb at such a time. Some however, either from prudence or nervousness, will pick very heavily then, regardless of whether or not the fruit is mature. This practice occasionally causes an already weak market to collapse.

All these practices together represent only a small part of the volume of fruit harvested, and under present conditions they may not be considered reprehensible. The total effect, however, is to put a certain amount of very poor quality fruit into trade channels, and I have been told that the ultimate effect is detrimental to the industry.

FUTURE PRODUCTION TREND

Estimates of future production must be based on bearing acreage and average yield per acre. Taking 9,000 as the acreage of bearing avocados in the near future, forecasting will hinge largely on estimation of the yield per acre, with due allowance for catastrophes.

In this connection I should like to mention the figures for average yield cited earlier in my discussion. These show an average in the neighborhood of 50 bushels per acre for all groves over three years of age. The reason for this low

average in the years of 1948 and 1950 is that the trees had been extensively damaged by the hurricane of September 15, 1945, and the groves were not back in proper production. The figures for 1951 and 1952 are low for a different reason. The acreage of bearing trees—at least of trees over three years of age—more than doubled in that period, because of extensive planting in the late 1940's. These trees were only in the three to five year age group and production on such trees is very light. Compare these figures with the average for eight year and older groves:

1950	107 bu. per acre.
1951	171 bu. per acre.
1952	154 bu. per acre.
1953	144 bu. per acre.

These show more clearly what may be expected in the future, when all those young groves reach maturity. Moreover, the groves which furnished the figures given above, being the older ones, contain many more of the lighter bearing varieties. According to the County Agent's Office, the young groves are composed two-thirds of Lulas, Booth 8's and Booth 7's which are the most prolific varieties we have, whereas the older groves average only 41% of these varieties. When the young groves get into full production it seems likely that the average yield per acre will be higher than it is now for mature groves. We must bear in mind, too, that many of the lighter bearing varieties will probably be top-worked to the heavier bearing ones. Calculating that the heavy bearing varieties will produce three bushels per tree, and that the rest will average 2 bushels, we get an average yield of 208 bushels per acre. This may seem like a reasonable figure but when it is applied to 9,000 acres the result is staggering in comparison with present production, over 1,800,000 bushels as against about 400,000 currently.

Adverse weather conditions will reduce the crop from time to time, and we must not forget that we occasionally have a catastrophic hurricane, but even allowing for those unfortunate events it seems clear that we have to look forward to crops, and marketing problems, of an entirely different order of magnitude from those that we have had in the past.