

## AVOCADO PERFORMANCE RECORDS

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*Mr. President, Ladies and Gentlemen:*

The reason for my presenting this discussion of the work of keeping individual avocado tree performance records is that Mr. L. B. Scott, in charge of this investigation for the U. S. Department of Agriculture, has written me that official duties prevent his attending this convention as planned, and requested that I prepare a paper on this subject in his stead. The only personal experience with avocado performance records which warrants my attempting this duty has been a very limited connection with the variety committee of this Association. The ideas which I will discuss in this paper have developed as a result of our experience during the past ten years while keeping individual citrus tree performance records. Enough evidence has been secured with avocado tree records to warrant the belief that such records are as important in the selection of parent trees and bud wood for the propagation of reliable varieties and strains of the avocado as has been proven to be the case with the citrus. In fact it seems to me that such records are more important for the avocado than for the citrus, for the reason that the commercial propagation of avocado varieties is still in its infancy. Therefore, it seems reasonable that exact information as to individual avocado tree behavior will enable the propagators and growers of avocados to avoid many of the mistakes made in the early propagation of citrus varieties.

My point of view is that the avocado growers and propagators have a wonderful opportunity at this time through tree performance record work to select superior varieties and strains for commercial propagation so that from the very beginning of this industry only valuable varieties will be planted in the commercial avocado orchards. I firmly believe that careful study along this line may shorten the experimental work essential to the selection of suitable varieties for new environment conditions at least twenty-five years. Furthermore, I feel sure that this work will enable commercial growers to avoid the serious mistakes usually incident to the introduction of new crops and in this way eliminate much of the loss and disappointment connected with the planting of unsuitable varieties in commercial orchards. I have long felt that the avocado propagators and growers in California have a unique opportunity to start off the commercial development of this industry along proven and reliable lines, and I believe that when they fully understand the importance of basing their selection of varieties and of parent trees within the varieties upon definite information and exact records that they will seriously take up and carry on this work.

I will briefly describe a method of keeping individual tree records. While this method will probably be greatly modified and improved with further experience it does meet the necessities of this work as fully as possible in the light of our present knowledge of this

subject.

## **OBJECT OF PERFORMANCE RECORDS**

The object of this work is to determine and systematically record the performance of individual avocado trees. These records include (1) a record of the number, weight, and commercial quality of the fruits borne by each individual tree; (2) the dates of each pick showing the season of production; (3) definite data as to the chemical composition and the physical characteristics of the fruits borne by each tree from year to year; (4) the development of improved methods of propagation in order to control the extent to which undesirable varieties and variations shall enter into the population of future commercial avocado groves.

## **PLAN OF RECORD KEEPING**

The first step in performance record work is to number each individual tree. The importance of individual tree numbers has been fully demonstrated in our citrus studies not only for keeping individual tree records, but also for giving the trees individual tree care in pruning, fertilizing, irrigating, and other cultural attention.

The most satisfactory tree number is a compound one consisting of (1) the number of the orchard or block of trees; (2) the number of the row of trees, always counting from a fixed point as the irrigation head; and (3) the number of the tree in the row. For example, a tree in block one, row three and the fifth tree in the row will have the number 1-3-5. While this number seems to be a complicated one at first thought, in reality it has proven to be the simplest and most efficient one devised as yet for this purpose.

The tree number can be applied to each individual tree by painting the figures upon the trunk or one of the main limbs, using pure white lead paint for this purpose. On very small trees the number must be arranged in a single vertical column on account of the size of the trunks. With trees of sufficient size, usually after the second year in the orchard, I think that the number can be arranged with the orchard or the block number first, the row number just below it and the tree number under the row number. The tree numbers should always be placed in the same relative position on all of the trees in order to assist the observers in finding them.

This arrangement of the individual tree number enables the grower (1) to find each particular tree in his orchard at any time without difficulty; (2) to note any tree condition at any time for immediate or future attention; (3) to easily connect a particular tree and its performance; and (4) to give the trees adequate and necessary individual tree care. The expense of applying these individual tree numbers is very small. At this time in the citrus it costs about two cents each to number the trees. The citrus tree numbers last for about five or six years after which period it is usually advisable to renew them. On account of the rapid growth of avocado trees it may prove necessary to renew the tree numbers more frequently than is the case with the citrus.

The second step in securing individual tree records is to adopt forms on which the individual tree data can be kept. The variety committee of this association have drawn

up a simple form for this purpose which seems to meet the essentials of this work. From our experience in similar work with the citrus I am of the opinion that these forms should be as simple and practical as is consistent in securing the information desired. With this object in view the variety committee have printed for distribution to members of this association the following form.

In some cases it will undoubtedly add to the convenience of the user to print these forms in small, durable vestpocket books. The owner's name and address should be plainly printed in a conspicuous place on the cover in order that the book can be easily returned if it is accidentally lost. These small, thin, convenient books may be found to be of real service in securing accurate individual tree records.

It seems to me it will be very desirable that, in so far as possible, performance records be secured according to a uniform plan. This uniformity will enable the Association to more easily and fully tabulate, digest, and study the information contained in these records in order that the knowledge thus acquired be made available for the benefit of the industry as a whole.

The third step in securing individual avocado tree records is the work of recording the yield of the trees, and other notes as to their behavior. The blank form of recording these data, shown below, is largely self-explanatory as to the important steps in recording the information. Of course it is essential to record the name of the grower, his address, the year during which the records are secured, the number of the variety or strain, the age of the tree, whether it is a budded or seedling tree, and the individual tree number. Not one item in this list can be safely left out. Any additional information which will be helpful in a future consideration of the performance record should be written in on the form.

THE CALIFORNIA AVOCADO ASSOCIATION  
INDIVIDUAL TREE PERFORMANCE RECORD

Grower.....Address.....Plat.....Row.....Tree.....

Year.....Variety.....Age of Tree.....Kind of Tree.....

Date of Pick	No. of Fruits	Wt. of Fruits	NOTES
TOTAL			

This blank can be extended to suit any number of records

The date of each pick is important in that these dates will give definite information as to the season of production of mature fruits for the individual tree.

The number of fruits picked and their weight gives the most important information to be secured. From the number and weight of the fruits the yield of the trees can be definitely ascertained with some idea of the size and value of the fruits. This information is of primary importance in considering the commercial value of any individual tree. If

possible, it is suggested that if marked variation in size of the fruits exists the weight of several of the largest and some of the smallest fruits be obtained in order to secure and record some definite information upon this condition. Other information which will aid in interpreting the performance records can usually be secured and recorded under the heading of notes. These notes may include temperature or wind records, kind, extent and nature of blemishes, or other explanatory descriptions of tree and fruit characteristics and conditions.

From experience gained in securing citrus tree records we suggest that field notes be taken with a medium or hard grade of lead pencil. Indelible pencil marks are likely to run and blur when accidentally moistened. A system of caring for the records which will prevent, so far as possible, loss from fire, accidental disappearance, theft, and other causes of loss must be used. One method of accomplishing this is to make duplicate copies of each record, one to be retained by the grower, and the other to be filed with the avocado association or other institution.

## **UTILIZATION OF DATA**

The number of seasons' records necessary in order to base conclusions depend upon circumstances. At this stage of the development of the industry the first fruits matured on all trees should be recorded. These data will give definite information as to the age at which the trees come into bearing. In other words, these records might properly begin with the budding or the planting of the seed as the case may be. In the early stages of tree growth when no fruits are produced this fact can be noted in the blank record form. This will provide positive evidence as to the early bearing habits of the trees. In any event it seems to me that an even number of seasons' records, as for example, two, four, six or eight, are preferable to an odd number in arriving at the average yearly production. If three seasons' yields are considered in the case of an alternate bearing tree and two of them show low production the average of the three years may be misleading. On the other hand with two high yielding seasons out of three the average of the three years will show a higher average yielding power than is truly the case. Of course with regular bearing trees this condition will not apply and any adequate number of seasons may be safely considered in getting at the average annual yield.

Our citrus studies have led us to emphasize the importance of a sufficient number of seasons' records to justify safe conclusions as to a tree's habit of bearing. With trees just coming into bearing I believe that four or six seasons' records are desirable before safe conclusions can be drawn and reliable selection of parent trees be made. With full bearing trees I think perhaps that two successive normal seasons' records will be helpful while probably four years' records will pretty surely indicate the habit of production of a particular tree.

The point which we want to emphasize in this connection is that tree records should be begun now. Do not wait. In order to get reliable records several successive seasons' records will have to be obtained. To secure these it is necessary to make a beginning. The only way to accomplish a thing is to make a start. As a matter of valuable public service for the avocado industry as a whole, as well as for private information, there is no more practical or important work than that of securing adequate individual tree

records from which safe conclusions can be drawn as to the variety, strain and individual tree behavior.

Other factors besides the number and weight of fruits produced each year which may properly be included in avocado performance records are the chemical composition of typical fruits, the proportion of seed to flesh, the color of the flesh and the rind, the thickness and other conditions of the rind, the description of any weakness in the tree or its fruit, the description of any blemishes occurring in the rind, in the flesh or other part of the fruit, or the tree, the effect of extremes of heat and cold on the tree, its blossoms or its fruit; the effect of drought or excess of soil moisture, the effect of fertilizers, the effect of wind, the appearance of any disease or insect pest and any other illuminating information which will likely prove to be helpful in the consideration of the variety, strain or individual tree.

Another related matter in this connection and one upon which more information is needed is the behavior of the fruits after picking. The stage of ripeness for picking in order to secure the best results in marketing is important. Both the stage of ripeness when picked and the factors taken into consideration when picking and the keeping qualities of the fruits are more or less unknown at this time as I understand it. Therefore, notes on the color and softness of the fruits or other conditions leading to the actual picking, the changes that take place during subsequent holding in storage and the conditions of storage may prove to be of great value in the successful marketing of the future commercial crops. It seems to me that there is something of a relation, in this problem, to the picking of Bartlett pears and their ripening during packing, shipment, storage, and display for sale. Or, perhaps, a more nearly related condition occurs in the picking and handling of other crops, as, for example, the cantaloupe. In any event I have confidence that the problems connected with the picking, handling, and marketing of the avocado will be solved as they have been for other fruit crops. If information in regard to these matters is collected as the industry grows it seems logical that the problems can be more easily met as they arise than if pains are not taken to secure such information.

Another point which occurs to me is that a sharp lookout should be maintained as to the variability of the fruits on the same tree. Any tendency to variability of fruits in size, shape or other characteristics should be recorded in the performance record notes. This information may prove of value in determining the kind of bud wood best adapted for propagation. It may also assist in avoiding the propagation of ever-sporting varieties or strains. In other words it may be of great value in working out improved methods of propagation.

It seems, from other related experience, that regular bearing varieties and strains are to be preferred to alternate or irregular bearing ones. While this condition is likely to be influenced in a great degree by climatic conditions such as extremes of temperature or humidity, and by cultural practices such as fertilization, cultivation, pruning and thinning, it is also probable that the tendencies of regular bearing and of irregular bearing are more or less inherent. If this is the case then performance records may prove to be very useful in the selection for propagation of regular bearing strains or those having a tendency to produce moderate crops regularly each normal year instead of large crops one year and small crops the following season.

## **SELECTION OF PARENT TREES**

The selection of parent trees as sources of bud wood for propagation should be based, if possible, upon adequate performance records and with that intimate tree knowledge gained through the systematic study of the tree and its fruits. In the early stages of an industry, where no such information is available, there is usually little selection of parent trees as there are few trees from which to select. There are now large numbers of avocado trees of many varieties coming into fruiting in California. If adequate individual tree records are secured from this time on the selection of parent trees for propagation can be made intelligently and more safely than where such work is left to individual recollections which are very uncertain at best, and to impressions which are likely to be affected more or less by personal bias or prejudice. Furthermore, parent trees are likely to be selected on the basis of some one season's behavior, as when the trees have a large crop, then the next season will show these trees to be almost barren. I maintain that performance records are the best means for studying the relative behavior of trees and of their comparative value for commercial propagation. In the experimental stage it is usually desirable to propagate almost everything available. When the propagations come to be used commercially it is important that only those varieties and strains be propagated which will meet the test of climatic, soil, cultural, and marketing conditions. The elements of success in avocado growing commercially will include regular production of crops which can be picked, handled, packed, shipped, distributed, marketed, and reach the consumer in good eating condition. The varieties adapted for this purpose, the best methods for their culture, the location of the orchards, and all other conditions favorable for this development will be more rapidly ascertained by securing and utilizing adequate individual tree records than by any other means with which I am familiar.

## **PROPAGATION OF SUPERIOR VARIETIES**

The selection of varieties for commercial planting will depend upon many considerations amongst which the following may be mentioned. These conditions are not stated in the order of their relative importance but rather in the way they occur to the writer.

- 1) Quantity of fruit. Other things being equal a regular heavy production of fruit is of primary importance.
- 2) Season of ripening. While I do not know that any one season is better than another for the marketing of avocados at the present time yet it seems likely that such will eventually prove to be the case. My reason for believing this is based upon experience with other crops. For example, the California grapefruit crops can only be marketed successfully in the East by avoiding competition with the Florida crop and by keeping out of the market largely during the cantaloupe season. As with the grapefruit, California avocados are bound to compete with the Florida avocados and are also likely to compete at some season with other crops used for the same purpose.
- 3) The size of fruits. The best commercial size of avocados has not been determined so far as I know. Up to this time the larger sized individual 'fruits seem to bring the most money. With other crops such as oranges, grape fruit, lemons, and potatoes the

medium sized fruits seem to be the most valuable for commercial marketing. Extremely large as well as very small fruits in these crops are likely to be discounted in the market if offered in any considerable quantity. With the avocado, however, some factors may be involved which will prove that the avocado is an exception to this rule. However, it seems likely that when commercial crops of avocados are produced in large quantities the fruits of medium size will prove to be the most easily sold. If so this consideration should be given careful thought by those preparing to set out commercial orchards.

4) The appearance of the fruits. The outside or external appearance, as well as the inside of the fruit are important considerations in marketing most food products. A distinctive appearance of the fruit should be a valuable characteristic of an avocado variety. The navel is a valuable factor in marketing the Washington navel orange crop. The bright red color of the fruits of several apple and peach varieties is an invaluable asset in marketing these crops. It may be that a striking and distinctive appearance of avocado fruits may prove to be an important factor in establishing and maintaining a market for such fruits.

5) Eating quality. It has often occurred to me that the food value of the avocado has not been fully emphasized from the standpoint of marketing the fruits. I do not know of anyone having questioned the food value of this fruit, but the facts, as to its high food value, are not generally known. But food value alone does not as a rule market the crops. People usually buy fruit because they like to eat it, although I think that there is an increasing consideration of food values since the war. In other words, fruit usually sells because of its eating quality. Fortunately the avocado combines both eating quality and food value. Personally, I eat avocados because I like them, crave them, and if available I would eat them regularly. On the other hand I liked them and purchased them whenever possible long before I knew that they had any food value.

6) Shipping quality. Different avocado varieties produce fruit having different texture of rind and flesh. Some are better adapted for packing and shipping to market than others. If a variety of avocados is grown for the purpose of marketing the crops, this shipping quality should be taken into consideration. The fruits of a variety may be admirably adapted for home use or for even local markets but will not make a good standard pack or hold up in good condition where the fruits are shipped to distant markets.

7) I do not know whether any information is available as to the comparative keeping qualities of the fruits of different avocado varieties. That such differences do exist there is not much doubt. A variety which produces crops that can be held in storage or under other conditions for a considerable period after picking is one meriting consideration. I think that one of the difficulties found in trying to introduce West Indian grown avocados in Eastern markets has been the poor keeping quality of some of the fruit; at least this is what several fruit dealers in New York, New Haven, Hartford and Boston have told me.

8) Shape of Fruits. In the citrus, fruits having a certain shape make a better commercial pack than others. This condition may or may not hold true for the avocado. It seems likely to me that it may. Therefore, other things being equal, the shape of the avocado best adapted for making a good standard commercial pack may prove to be an important factor in selecting the variety for planting in orchard form.

## **EXAMPLE OF AVOCADO PERFORMANCE RECORDS**

I have secured from several avocado growers the individual tree records which they have been keeping. The data in these records are frequently incomplete from my point of view. It is with the hope of stimulating more complete records and encouraging greater attention toward this subject that I am presenting these data and suggestions as to their improvement from the standpoint of securing adequate data from which safe conclusions can be drawn as to the selection of varieties, strains, and individual parent trees for propagation.

Several years ago the California Fruit Growers' Exchange, a cooperative organization of about 10,000 citrus growers, established a department of bud selection. This department has been self-supporting through the sale of selected buds from its beginning. Last year 230,000 buds selected from superior parent citrus trees were sold to propagators. These buds were sold for five cents each to members of the Exchange and six cents each to others. An experimental nursery has been established in Lamanda Park for testing stocks, buds and methods of budding. The fall season of budding for this year has just begun and more buds have been ordered than were sold during all of last year. As the spring season is the popular budding time for the citrus it seems likely that this department will sell about a half-million buds. More than a hundred bushels of citrus seed was planted for stocks last spring and we anticipate a demand for more than a million selected citrus buds next year.

Is it not possible that some similar organization may become advisable and necessary for the avocado industry?