REPORT OF

Eighteenth Annual

Date Growers' Institute

APRIL 26, 1941

HELD IN

COACHELLA VALLEY

CALIFORNIA

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THE DATE INSTITUTE
Indio, California

Eighteenth Annual Date Growers' Institute

Saturday, April 26, 1941

MORNING SESSION

Chairman, W. H. Wright, Agricultural Commissioner, Riverside County

It is an honor and pleasure to have the opportunity to act as Chairman of this morning session of the Eighteenth Annual Date Growers' Institute. I thank you for this courtesy.

My first visit to the Coachella Valley was during June, 1920, when a class in sub-tropical horticulture at the University of California in Berkeley included this area in a summer travel trip. During the two or three days we spent in this Valley we visited numerous date gardens and packing plants, learning something of the special problems of this industry. It has been interesting to me ever since.

The date industry is unique in that practically the entire commercial production of the United States is in the Coachella Valley. Like many other California agricultural commodity - groups you have cooperated together with governmental agencies to solve your problems. The eradication of date scale is a notable example. More recently the formation of your Date Marketing Agreement to assist in increasing returns to the growers has been an example to other agricultural groups faced with a similar problem.

Thus it is commendable to note the continued interest in your problems, as evidenced by the large attendance present to hear today's program and take part in the discussions. In fairness to the speakers we will proceed with the program.

THE DETERIORATION OF DATES

By E. M. Mrak, Fruit Products Laboratory, University of California, Berkeley

The deterioration of dates and other dried fruits in storage is a problem of considerable importance and may result in undesirable changes in appearance, taste and food value of the fruit. In the past, much of this deterioration has been either overlooked or taken for granted as changes expected to occur during storage. In fact, handlers of dried fruits sometimes still fail to realize that certain changes occurring during storage may be manifestations of an incipient deterioration rather than those of storage "maturation." It is not necessary to point out that this state of affairs has resulted in appreciable losses in quality and value of much dried fruit.

There are several types of deterioration, the importance of which vary with the particular fruit and the conditions of storage. The most common types of deterioration are insect infestation, darkening, "sugaring" and microbiological (souring, fermentation, mold growth).

Insect damage is a problem of great importance to all dried fruit industries since infestation may occur in the orchard, packing house, during shipment or even on the grocer's shelves. Care must be taken at all times to prevent infestation. This is best done by use of orchard and packing house sanitation. Effective fumigation with a gas such as methyl bromide should be used as frequently as is necessary to control infestation. It is advisable to fumigate dates before placing in cold storage since, some of the dried fruit insects can withstand the common cold storage temperature for considerable periods of time. Cold storage, however, does tend to retard insect activity.

Darkening of dried fruits is another type of deterioration of importance since it is usually accompanied by undesirable changes in appearance and taste as well as a loss in vitamins, particularly A and C. This type of spoilage has been observed most commonly in cut fruits such as apricots, peaches and pears although it may also occur in dates and other fruits. Sievers and Barger (1930) have discussed in their bulletin certain factors affecting the discoloration of Deglet Noor dates.

The best procedure known for preventing discoloration of unsulfured fruits are more thorough drying than is commonly done and storage at a relatively low temperature. According to Sievers and Barger, properly matured dates may be stored for several months at 32° F. The combination of a high moisture content in the fruit and storage at high temperatures such as 80-100° F. accelerate this type of deterioration. The exact nature of the processes involved in darkening are not known although recent work of Weast and Mackinney shows that the darkening of dried apricots is due to a chemical rather than an enzymatic reaction. Those interested in the chemical aspects of the darkening of food products will find a comprehensive review of the subject in a recent publication by Joslyn (1941).

"Sugaring" is a type of spoilage of greater importance to the prune and fig industries than the date industry. In the case of dried prunes and figs "sugaring" consists of a mixture of glucose sugar crystals and yeast cells. These yeast cells cause an active or incipient fermentation which results in undesirable changes in taste, odor and appearance of the fruit. In dates on the other hand, the "sugaring," which occurs under the skin rather than on the surface of the fruit, consists primarily of sugar crystals. Yeast cells are usually present in relatively small numbers so the problem in this case resolves itself primarily into the prevention of sugar crystallization by control of storage temperature and moisture content of the fruit. Fermentation on the other hand may cause considerable damage to dates as well as other unsul-

fured dried fruit. In wet years dates may undergo an active and very noticeable fermentation. It is manifested by the presence of the familiar alcoholic fermentation odors and changes in appearance. In contrast to this rapid and obvious type of fermentation a slow or incipient fermentation may occur during the storage of under-cured fruit. This type of fermentation, which is caused by sugar tolerant yeasts, may go on for several months before it becomes very noticeable. During this activity, however, the undesirable changes caused by fermentation are taking place.

The fermentation of dates is usually caused by species of yeast belonging to the genus Zygosaccharomyces. These yeasts are characterized by the fusion of the contents of two conjugating cells prior to ascospore formation. All cultures of Zygosaccharomyces isolated from California were found to be unusually tolerant to high concentrations of sugar. All were capable of fermenting, within 24 hours, a date table syrup containing 66 per cent sugar. This explains why these particular yeast can grow and cause the spoilage of apparently well-cured dates.

Although Zygosaccharomyces are primarily responsible for the fermentation of dates other yeasts may also be involved. Cultures of Hanseniaspora and Candida have been isolated mostly from relatively moist dates. Yeasts of the genus Hanseniaspora are characterized by having pointed lemon shaped cells and hemispherical or hat shaped ascospores. Yeasts belonging to the genus Candida do not produce ascospores, but tend to form chains of adhering cells and buds termed pseudomycelia. Cultures of Hanseniaspora and Candida do not tolerate as high concentration of sugar as do the cultures of Zygosaccharomyces. Hanseniaspora and Candida cultures isolated from dates grew in date syrup containing 50 per cent of sugar but failed to grow in syrup containing 60 per cent of sugar. The lower sugar tolerances of these organisms explains their more frequent occurrence in rather moist dates.

The three genera of yeast discussed above apparently are widely distributed throughout the California date producing areas. Cultures of Zygosaccharomyces also have been isolated, a number of times, by Italian and Swiss workers as well as the writer from Egyptian dates. In fact, yeast obtained from fermented Egyptian dates shipped to Berkeley in hermetically sealed cans were similar in all respects to those most commonly isolated from California dates.

Thus far the discussion of yeast spoilage has been restricted to fermentation and nothing has been said about souring. In contrast to fermentation which results in the production of alcohol and an alcoholic odor, souring results in the formation of acetic acid or vinegar, and a sour, vinegar like odor. Souring is usually caused by vinegar bacteria converting the alcohol, produced by the fermenting yeasts, into acetic acid or vinegar. The odors caused by fermentation and souring are quite strong and very frequently attract insects, particularly the dried fruit beetle. When this occurs in the packing house it is evident that the insects will eventually leave the spoiled fruit and attack good fruit. From the standpoint of general sanitation and the control of insects, fermented fruit should never be mixed with sound fruit.

The control of microbial spoilage is a difficult problem insofar as California dates are concerned. General orchard and plant sanitation, of course, is helpful in preventing the spread of yeast and bacterial contamination, but it alone will not eliminate the trouble. Clague and Fellers (1933) stated that pasteurization renders packaged dates free from the usual pathogenic and spoilage microorganisms and insects, and improves the appearance and flavor. Furthermore the operation was considered commercially feasible. Temperature, time and humidity conditions found effective in pasteurization of dates were as follows:

87° C. for 20 minutes at 96 per cent relative humidity or above.
82° C. " 30 " " 75 " " " " " "
77° C. " 40 " " 69 " " " " " "
71° C. " 50 " " 90 " " " " " "
66° C. " 60 " "100 " " " " " "
63° C. no effective pasteurizing time under 80 minutes.

The pasteurization of foreign dates is commonly practiced in the east with satisfactory results, although it is not used on California dates. Experiments conducted by Sievers and Barger (1930) on the pasteurization of California dates were said, by the authors, to be inconclusive. Nevertheless, indications were that the quality of the fruit is better maintained by cold storage although the beneficial action of heat may control mold growth and destroy invertase.

The use of cold storage is one of the best means by which microbial spoilage may be inhibited. The difficulty with its use is the necessity of educating brokers in the use of cold storage for all fruit to be held for several weeks during the summer months. Several years ago the Dried Fruit Association of California recognized the importance of holding fruit in cold storage during the summer to prevent spoilage. In order to encourage distributors to use cold storage during the summer months, a form letter is sent to each distributor in April of each year. The letter indicates that May 1 is the start of the cold storage season and dried fruits should be treated accordingly. This letter also contains brief instructions for storing and handling dried fruits during the summer season.

The question of the use of fumigation to control microbial spoilage has been placed before us a number of times. Experimental evidence indicates that the Zygosaccharomyces yeasts obtained from dates can be killed with ethylene oxide or methyl bromide but the time and concentrations required are much greater than those used for the control of insect infestation. Furthermore, there is no data available to indicate that these gases would penetrate into dates or between tightly packed dates sufficiently to kill the yeast and bacteria. Fumigation, however, would undobutedly retard or prevent surface growth of microorganisms.

References

Clague, J. A. and C. R. Fellers (1933). Time, Temperature and Humidity Relationships in the Pasteurization of Dates. Archiv. f. Mikrobiol. Bd. 4, S 419-426.

Joslyn, M. A. (1941). Color Retention in Fruit Products. Ind. Eng. Chem. 33: 308-314.

Sievers, A. F. and W. R. Barger (1930). Experiments on the Processing and Storing of Deglet Noor Dates in California. U. S. Dept. Agr. Tech. Bul. 193. p. 1-23.

SECOND REPORT UPON COLD STORAGE OF DATE POLLEN

By W. W. Aldrich, Senior Horticulturist, and C. L. Crawford, Assistant Scientific Aid, Division of Fruit and Vegetable Crops and Diseases, U. S. Bureau of Plant, Industry, Indio, Calif.

The emergence of many early inflorescences on female date palms before the opening of an adequate number of inflorescences on available male palms continues to result in a scarcity of pollen in early spring for many growers. The storing of pollen from one spring to the next offers a practical solution, providing the pollen can be kept 11 or 12 months without appreciable loss of viability.

In 1938 Crawford (1) reported that pollen stored (in stoppered bottles) at 8° F. gave a satisfactory set of fruit. However, the lack of 8° F. storage facilities nearby has tended to discourage the commercial utilization of this method. Therefore, the storing of pollen in an ordinary electric household refrigerator was tried and found successful if pollen was kept dry.

Pollen from Mosque (a seedling male palm at the U. S. Date Garden) in 1939 was kept until March, 1940, under three temperature conditions:

1 - Open shed conditions
2 - 8° F.
3 - Household refrigerator (temperature at about 40° F.)

The pollen was held in a small glass container with open top, with this glass container inside a large glass jar having an air-tight lid. The large glass jar contained chemicals necessary to maintain the desired approximate relative humidity of the air in contact with the pollen:

0%	relative	humidity	dry calcium chloride
12%	"	"	a saturated solution of zinc chloride ($ZnCl_2 \cdot 1\frac{1}{2} H_2O$)
50%	"	"	a saturated solution of calcium nitrate ($Ca(NO_3)_2 \cdot 4H_2O$)
88%	"	"	a saturated solution of potassium chloride (KCl)

In March, 1940, each lot of 1939 pollen was applied at least five times on Deglet Noor, in comparison with fresh (1940) Mosque pollen, with the usual precautions to minimize contamination by wind-blown pollen. The fresh (1940) pollen caused 60 percent of Deglet Noor flowers to set fruit, which is an adequate set for a good commercial crop of this variety. Flowers covered with bags and not pollinated had 6 percent of flowers setting seedy fruits, indicating that even with usual precautions some wind-blown pollen got under the bags.

The percentage of Deglet Noor flowers setting fruit in 1940 for each lot of stored, 1939, pollen is given in Table 1.

Table I.—Percentages of Deglet Noor flowers setting fruit in 1940 when pollinated by 1939 pollen stored 11 months under different conditions of temperature and relative humidity.

Temperature conditions during storage	Relative humidity (approx.) during storage	Percentage of flowers setting fruit
Open shed	0 percent	2 percent
	12 "	3 "
	50 "	2 "
	88 "	(pollen molded)
8° F.	0 percent	60 percent
	50 "	56 "
Household refrigerator (about 40° F.)	0 percent	51 percent
	12 "	61 "
	50 "	18 "
	88 "	(pollen molded)

Pollen Stored in Open Shed

The almost complete lack of fruit set with pollen stored in an open shed substantiates earlier results indicating that pollen stored in this way can not be expected to set fruit.

Pollen Stored at 8° F.

The 56 to 60 percent set of fruit with 1939 pollen stored at 8° F. was about equal to the set of fruit with fresh, 1940 pollen. Thus, as indicated in the earlier report (1), pollen stored from one year to the next at 8° F. may be expected to give about as satisfactory a set of fruit as fresh pollen.

Pollen Stored in Household Refrigerator

The pollen stored at about 40° F. in a household refrigerator at 0 or 12 percent relative humidity resulted in about as good set of fruit as did fresh pollen or pollen stored at 8° F. However, pollen stored in a household refrigerator at 50 percent relative humidity resulted in a poor set, indicating the importance of keeping the pollen as dry as possible.

Pollen dried in the spring of 1939 in the usual commercial manner and then stored in a tightly lidded fruit jar in a household refrigerator (without additional means of keeping low humidity over pollen) resulted in 55 percent of the flowers setting fruit. This set is as good as that obtained with pollen in a household refrigerator with dry calcium chloride or a saturated solution of zinc chloride to keep the relative humidity of the air around the pollen at about 0 or 12 percent. Apparently it is possible to keep pollen dry if it is well dried originally and if the jar is very tightly lidded.

Conclusions

If date growers wish to store pollen from one season to the next, to insure a supply of pollen for early pollination, dry pollen stored in an air-tight container in a household refrigerator may be expected to be about as satisfactory for use on Deglet Noor as is fresh pollen. To insure keeping the pollen dry during storage, the jar holding the pollen should be left open but kept in a larger, air-tight container, in the bottom of which are well-dried lumps of calcium chloride. About a pound of calcium chloride for each 5 pounds of pollen should be adequate. Although pollen was kept satisfactorily in a household refrigerator in a tightly lidded jar without the calcium chloride, such a practice involves the risk of leakage of damp air into the jar and the resulting spoiling of the pollen. Pollen stored under open shed conditions can not be expected to give a satisfactory set of fruit, even if kept in jars with extremely dry atmospheres.

References Cited

(1) Crawford, C. L. Cold storage of date pollen. Date Growers' Institute Ann. Dept. 15:20. 1938.

PROCESSING AND MARKETING SUBSTANDARD DATES

By Hugh W. Proctor, Manager Coachella Valley Date Growers, Inc.

It is appropriate that the marketing of dates for manufacturing purposes be discussed here at this time. The dates used for this purpose are, as you all know, **substandard dates.** Heretofore. the chief problem has been to find a successful method of keeping such dates out of the normal channels of trade where they had for years been used as competitive material to the detriment of the reputation and price of standard grades of California dates This condition prevailed to such an extent that many date growers became convinced it would be profitable to destroy all substandard dates in order to stop this evil practice.

Establishment of Substandard Pool

Since the establishment of the substandard pool in 1936 and the State Marketing Order for Dates in 1938 substandard dates have been kept out of competitive channels. Now the chief problem has become to find suitable and profitable outlets for substandard dates received into the pool.

Under the provisions of the Marketing Order for Dates, no substandard dates can be sold as whole dates. The Marketing Order is operated under the supervision of the State Director of Agriculture and its provisions and grade regulations are enforced by authority of the State

The Federal-State Shipping Point Inspection Service acts as Inspection Agency. Regular inspection is conducted in all packing houses during the grading season and in addition periodic inspection is made of dates offered for sale in the retail markets.

Generally speaking, harmony has prevailed. During the first year that the Marketing Order was in operation there was one legal case in which the interpretation of the language used in defining the size of substandard dates was questioned. Following this the Order was amended and general satisfaction has prevailed since that time.

Practically all date growers are now convinced that more dollars are realized from the sale of the entire date crop when the substandard dates are not permitted to be sold as whole dates but are used for by-products and thus kept out of competition with standard grades of dates.

Preparation of Dates For Manufacture

As stated above all substandard dates are used for manufacturing purposes. The first step taken in preparing them is to pit and crush them. This is done by a very ingenius machine developed for this purpose by Mr. Elliott of Fresno. In pitting and crushing dry dates, enough moisture is added to bring the resultant product to the degree of softness desired by most manufacturers. This in itself requires skillful knowledge and judgment. If the product is made too soft it loses its keeping qualities and its flavor. If it is made too dry and hard, manufacturers object. At present a great deal of thought and effort is being given to this one detail and many experiments are being made in order to find the best method of turning out a uniform, suitable product. One great difficulty is the lack of uniformity in the dates themselves. Coming to us from many different packing houses situated in all parts of the date growing region and having been grown on different types of soil, under different management, it is not surprising that the fruit varies considerably in color, texture and degree of moisture. Much has been done already to overcome this variance by proper and careful handling at the time of pitting and by blending the fruit. When necessary the soft fruit is separated from the dry and stored under different lot numbers. This fruit is sold later to customers who desire it for their own special purposes.

When properly and freshly made, California date confection has a flavor superior to most candies and confections on the market. This fine flavor is easily lost if it is not properly handled when placed on the market for sale. Experiments are continually being made to find ways of preserving this flavor and improving the keeping qualities of the finished product.

Unquestionably, a better product is being turned out than when the program first started a few years ago. We are confident that continued experiment can and will continue to improve both its flavor and keeping quality.

Development of New Products

Along with this effort to improve the quality of California seeded dates, work is being carried on to develop as many practical new commercial uses as can be found.

At present by far the largest outlet for seeded California dates is as a confection. However, many other uses already exist, not yet large in volume but promising and steadily increasing.

We especially desire to increase the use of seeded California dates by the baking trade. First because this possible outlet is very large and second, because this outlet is absolutely noncompetitive with natural California dates. For years the bakery trade has been accustomed to use imported pitted dates and so far we have not been able to displace this use with our California seeded dates. This is due principally to the fact that these lose their distinctive flavor when subjected to extreme heat. This problem is being studied and we hope and believe that it can be solved. Fortunately at the present time, pitted imported dates are somewhat higher in price than normal and therefore bakers are more willing to experiment with our California seeded dates. It is entirely possible that a satisfactory use for our product will be developed for the bakery trade. When this is done a potential outlet will be opened capable of using any production of substandard dates possible for many years to come.

Marketing Seeded Dates

In addition to establishing a pool to receive substandard dates, preparing them in an acceptable way for manufacturers, and developing new uses for them, it has been necessary to set up a plan for orderly marketing of the prepared product.

For the first two years after the establishment of the pool, substandard dates were sold as whole dates, under a contract to pit and crush them before being resold.

This method of marketing was found unsatisfactory and was discarded. Since that time all dates received into the pool have been seeded and crushed before being sold. Important steps, as already recited, are being taken to improve and to standardize the product and its container, so that it will be delivered to the manufacturer in the best possible condition.

TABLE I

Production, Sale and Consumption of Substandard Dates from 1936 to 1941

Crop Year	Whole Dates Received Pounds	Sales	Manufacturer's Use	Date	On Hand
1936	1,231,470	25,500	No record	12/31/36	1,205,970
1937	1,532,550	1,235,070	No record	12/31/37	1,502,550
1938	1,800,600	1,749,510	No record	12/31/38	1,553,640
1939	1,653,570	1,597,468	2,024,814	12/31/39	1,609,742
1940	2,752,020	3,518,032	2,621,192	12/31/40	842,736
Totals	8,970,210	8,126,480			

(Pounds -- Whole Date Basis)

Table I shows the production sale and manufacturer's use of substandard dates from 1936 to 1941.

Beginning with the 1938 crop, all substandard dates were seeded and crushed by CVDG and sold on that basis. Receipts and returns have continued to be made on the basis of whole dates.

In Table II below, statements of the 1938, 1939, and part of the 1940 crop operation is shown on a pound basis.

TABLE II

Receipts, Sales, Expenses and Returns for Substandard Dates

1938 Crop Operation			
Whole Dates Received		1,800,600	
Seeded Product		1,640,350	
Receipts Per Pound			
Diversion Payment	$ .035		
Sales	.042		
Total Received per Pound			$ .077
Expenses Per Pound			
Manufacture and Storage	.0180		
Administration	.0036		
Selling	.0028		
Total Expense per Pound			.024
Paid per Pound to Growers			$ .053
1939 Crop Operation			
Whole Dates Received		1,653,570	
Seeded Product		1,402,113	
Receipts Per Pound			
Diversion Payment	$ .030		
Sales	.048		
Total Received per Pound			$ .078
Expenses Per Pound			
Manufacture and Storage	.0180		
Administration	.0034		
Selling	.0071		
Total Expense per Pound			.028
Paid per Pound to Growers			$ .050
1940 Crop Operation (Incomplete)			
Whole Dates Received		2,942,940	
Seeded Product		2,366,102	
Receipts Per Pound			
Sales (on portion sold)	$ .0494		
Expenses Per Pound			
Manufacture and Storage	.0101		
Administration and Selling	.0058		
Total per Pound on Entire Crop to Date			$ .0159

While all payments to growers have been made on the basis of whole dates, all sales beginning in 1938 have been made on seeded basis. The average price per pound for the seeded product has been as follows:

1938 Crop Seeded Dates	$.0477
1939 Crop Seeded Dates	.0574
*1940 Crop Seeded Dates	0609

*Incomplete

In October, 1939, a standard price per pound F.O.B. Los Angeles was established for California Seeded Dates, which has not been changed since, as follows:

Up to 1,000 pounds - -	7½c
1,000 to 25,000 pounds -	7¼c
25,000 to 50,000 pounds -	7c
50,000 to 100,000 pounds	6¾c
100,000 to 200,000 pounds	6½c
200,000 to 400,000 pounds	6¼c
400,000 pounds or more	6c

During the past five years, we have found that practically all users of seeded dates desire to buy their supply from us, the original source. This is a matter of considerable importance and assistance to us in selling and distributing the product.

Our established policy is to sell our product to all buyers in accordance with the published price list. By doing this and by maintaining a steady, even price level, we have been able to gain the confidence of all users of California seeded dates. Every legitimate means is being used to increase the sale and use of our California seeded dates but no attempt is made to do it by special price concessions and allowances to favored customers. Every promising outlet has been followed up. Every firm and agency with responsible financial backing desiring to use our product, has been encouraged.

This policy of maintaining a steady, fair price level, of encouragement and assistance to legitimate buyers and users, of developing and using all possible outlets, has resulted in the establishment of confidence among all buyers that they would be protected against price declines and unfair discrimination.

The CVDG has a settled policy of marketing based on the principal of equal treatment to all firms desiring to buy, of selling to every financially responsible buyer. We are confident that this policy, if continued, will result in taking care of normal increases in tonnage to be expected during the next few years and will bring the highest returns possible to the growers.

Distribution

During the first two years of the Diversion program, practically all of the substandard dates were sold to California manufacturers and buyers.

As deliveries to the pool increased it became desirable to expand the marketing program to include the Middle Western and Eastern territory. A moderate stock of seeded dates is now carried in storage in Chicago and New York in addition to Los Angeles. This enables us to make rapid deliveries to Eastern firms whenever orders are received.

It has not been necessary for us to set up a complicated marketing organization because most manufacturers using our product, buy in large quantities and distribute the finished product themselves. There-

fore, a comparatively few buyers use large quantities of the raw material.

A very few manufacturing firms strategically located throughout the United States can successfully handle the total production of substandard dates and so distribute the finished product that the markets will be supplied in the most economical manner. Firms using one hundred thousand pounds or more per year have been found to be the most valuable to us for the reason that when the volume is this large, machinery and equipment must be bought and it cannot be dropped without severe loss.

On the other hand, a firm which uses only a few thousand pounds per year can drop this part of its business on short notice without much, if any loss.

At the present time there are several large, well-established California firms, regularly buying our product for manufacturing purposes. They in turn distribute their own finished products, so that the Pacific Coast States are well covered from a marketing standpoint. Last year a fair sized contract was made with a good firm in the East. Two months ago a similar contract was made (not directly by us but for our product) with a good firm in the Middle West. This was the first large scale sale made in this territory and encourages us to believe that now the ice is broken, we will be able to increase our business rapidly there.

We believe that the surface of the west market of the United States has been barely scratched yet. Our product is new and our job is to introduce it to the trade centers of the country from where it will expand in ever widening circles until the entire country is reached.

Summary

The establishment of the substandard pool was the first and most essential part of the Date Diversion Program. This pioneering work has been done and the pool has been in operation long enough so that its value has been demonstrated to all growers and handlers.

Enough experience and information has been gained about the proper handling and preparation of dates so that a desirable product can be made. More information is being sought by experiments so that the product may be improved in quality, color, flavor and uniformity as rapidly as possible.

Manufacturers are encouraged in every way to develop new products and to find new uses for California seeded dates. In addition we are attempting to find new outlets for our product.

A difficult problem was encountered in marketing California seeded dates as the product was new and different from any heretofore sold. The volume produced is too small to justify advertising on a national scale but too large to sell in local markets. The problems of national distribution are present therefore, without the saving factor of volume over which to spread cost.

In spite of this handicap however, the volume of sales and consumption has been constantly increased each year without prohibitive selling cost. This year, on January 1, 1941, the dates delivered to the pool were 88% sold. At that time it appeared that there might not be enough stock on hand to supply the demand until the new crop was ready, but additional deliveries to the pool since that time have greatly enlarged our stock so the supply is ample. The actual consumption of this product was 24% greater in 1940 than in the preceding year. The sales and consumption are now for the first time on a current basis with the deliveries. This has been accomplished in spite of constantly increasing deliveries to the pool.

We, therefore, face the future with confidence that sales and consumption can be increased along with normal increase in production. We believe that prices can be held stable and perhaps gradually increased as more buyers use our product in response to our sales efforts.

PRESENT PROBLEMS IN MERCHANDISING THE CALIFORNIA DATE CROP

By Eugene C. Jarvis, Manager United Date Growers of California

This paper has not been prepared by one who claims to be an expert on merchandising. In fact, all points which will be brought out, are at the present time, being used for the merchandising of similar food products. Many of them have been recommended and tried out by the date industry in previous years. The point I wish to stress, however, is that after a program is set up, its success depends on how it is executed. The best plan in the world cannot work if it is not properly supervised. In order to present a clear picture on the present methods of merchandising dates, it seems necessary to review briefly a little past history.

The first commercial importation of date off-shoots in any quantity started in 1912 and continued for several years. By 1924 production had reached about 450,000 pounds with most of it being sold direct to consumers as a novelty and confection. Growing and packing costs were high, but the grower received close to 25c per pound for his crop. However, production grew faster than this type of market could be developed. In 1932 the lowest ebb of date history was reached. Production had passed the 4,000,000 pound mark and costs had not been sufficiently reduced, nor the market sufficiently expanded for date growers to receive the cost of production. In other words, there were two essential problems to be met, that of reducing costs, and that of expanding the market on a commercial basis.

Each grower attacked this problem in his own way and improvements were made. In 1936 the C. V. D. G., Inc., was organized to control the sub-standard grade, and the United Date Growers of California was organized in 1937 to efficiently distribute dates, standardize grades, develop markets, overcome destructive competition and help finance the growers.

In 1940 there were approximately 3,000 acres of bearing date palms in California, with an approximate yield of eleven and one-third million pounds, which will gross close to $1,000,000 to the Valley. Grading and servicing charges, of course, will have to be deducted before the growers' net return can be determined. Growing and marketing dates is the Valley's largest industry.

Today we find two major problems still with us, one of improving production and keeping costs down and quality and tonnage up; the other of developing markets and economically merchandising the crop after production. These two items are extremely important at the present time, as there is now a potential production of twenty million pounds within the next few years.

Only one problem, that of merchandising, will be discussed in this paper. United Date Growers has found that there are five main points to consider: (1) Distribution, (2) Standardization, (3) Market Development, (4) Competition, (5) Financing. At the present time we find over 85% of the growers meeting these problems through the two local growers co-operative organizations, Coachella Valley Date Growers, Inc., and United Date Growers.

The problem of distribution actually starts with the growing of the crop and does not end until it is sold. However, this problem will be considered at the present time, as starting with the shipping and ending as soon as it reaches the retail store.

It became quite apparent that the logical way to accomplish this was to work in conjunction with other products so as to reduce the overhead. This policy has been followed and Calavo, Incorporated, was employed as sales agent. They, in turn, distribute through distributors or brokers that are handling other products, as well as through direct contact with wholesalers and chains. The larger population centers must first be developed as it is more economical to ship in carlots and serve many stores within a small radius than it is to make express shipments and then find the stores widely scattered. Obviously, the shipping has to be carefully planned so that all the crop is not sent to a few points necessitating price reduction or re-transportation.

The different grades have more or less been standardized over a period of years. However, in the past there was nothing to prevent each individual grower from chiseling on those recognized grades and selling lower grade fruit as top quality to unsuspecting customers. This, of course, did not help build a quality reputation for California dates. The biggest advance made in this line was the establishment of the date marketing order which prevented the sub-standard grade of dates being marketed in whole form. Also, the standardization of the commercial grades was greatly improved when the growers formed their own marketing organization, United Date Growers. Grade specifications were set up and all packing houses cooperated with the inspection staff so that more uniform and dependable grades were obtained. By establishing a brand and being able to have a dependable source of supply merchandising has been greatly improved. This has eliminated a "hand to mouth" buying and enabled the purchaser to know what he was getting.

To emphasize the importance of maintaining grade standards and only selling quality California dates, I quote a letter received April 5th from Chicago. This letter was written by one of the industry's eastern sales heads on the subject of "Independent Date Shipments:"

"You will probably be interested in knowing what has been happening to those dates the independents were reported to have shipped to the East last fall.

"In New York some of their bulk and packages were sold at prices lower than we have had all season. Their packages are very poor as you probably know, and I have always said that no matter how bad all the date industry packs may be, these people can always come up with the poorest in the entire industry.

"In the past month or so, one shipper reported to have a flock of bulk dates in New York and appealed to another cash buyer to see if his eastern representative could not sell a few. His man looked over the stock — something over 1,000 cases, so I was told—and the quality was terrible; would not sell for $1.00 per box.

"At Chicago, a broker here quoted via postcard at prices considerably lower than our asking prices, and I believe I sent you one of these a couple of months back. Recently, they have been trying to clean up, offering alleged 'choice' down to $1.60 and a few of the local 'undertakers' are retailing at 14½c per pound; about what we are trying to get in a wholesale way. These dates are pretty good size, but a mixture of our choice and standards, and colors mixed as well, from light dates to dark dates. Sort of a 'Duke's Mixture.'

"Another Greek in the Loop bought 150 boxes or so, but upon taking delivery of 25 the other day, he cancelled the entire order as they were terrible. Come to find out, in order to save a few cents storage, they were apparently stored in common storage in Chicago, without refrigeration, and now they are pretty well dried out and practically unsalable at anything but low, salvage prices. Supposed to be 500 to 1,000 left.

"All in all, it looks like the independent cash buyers will be a little sick before they clean up, or maybe this will even kill some of them off in the date deal."

With the distribution and standardization methods set up, the matter of developing the market was much easier. Dates, of course, are not a necessity and are not generally demanded by the consumer. The first step was to convince the merchant that he could move a volume and make a good profit. After all the retail store has only so much floor space and will not handle any item that does not pay. The most satisfactory method was that of furnishing point of sale advertising material such as back-board display, price cards, banners and consumer booklets. Actual date bunches and fronds were sent back East for display purposes. Once the dates were properly placed and displayed, consumer interest ran high. It was, of course, necessary to get the store to place the date display in a favorable location.

By following this up with properly handled demonstrations, results were always obtained and once a success was made in one store, pictures were taken and shown to others who then were more easily persuaded to handle California dates. The same procedure, more or less, was followed in all types of stores. Department stores and health food stores proved to be good outlets for quality merchandise. Chain stores and independent stores sometimes handled all grades, but some would only handle the lower grades. Back door outlets had to be found to move the low quality fruit so that the reputation of California dates and that of the selling organization would not suffer.

Dates are generally sold in three classifications: (1) Specialty and fancy packs to the higher type stores; (2) consumer packages to the grocery department and chain stores; (3) bulk dates to the produce departments. The higher type markets have always been the biggest problem as there is not large enough volume to pay for the cost of the necessary development. In fact, this should be at least a three year program. The consumer package business is just coming into its own, and a large volume can be moved by this method. The produce market is the most developed at the present time and relieves the burden of having to package the entire crop. Many sales are, of course, made to commercial packers and distributors

who pack and distribute under their own brand. Eventually the marketing of the by-products made from sub-standard dates will have to be included with this program to completely round out the date deal and further reduce overhead.

Consumer packages are playing a more important part each year as a good many of the Eastern stores are of the self-service type, or handle orders by phone. These packages also provide an excellent means for advertising and give better control on quality. The chains play a vital part in cheap merchandising and one contact can be made at the head office for some 100 to 1,000 stores. They also like to deal direct and considerable handling and commission can be saved. The consumer price can be kept in line for volume movement, and the net return to the grower increased.

In all this work it was found that if a representative direct from the growers makes the contact, more results can be obtained. Such a representative has been used this year, under direct control of the growers, and by being properly trained and having the proper background, many contacts were made that would otherwise have been lost. The fact that this representative has just come from California and just gone through the date gardens gives the right amount of romance and atmosphere. A motion picture of the date industry is being used constantly. Large concerns like to have it shown at their sales meeting as it gives that personal touch and necessary enthusiasm to obtain volume sales.

At the present time, dealer service work and distribution are more important than direct consumer advertising. It is quite obvious that dates cannot be placed in every small city, nor every small store throughout the country as there is not sufficient tonnage to obtain a large enough movement to pay for the necessary overhead and to show the store a profit. With our present tonnage, it is more satisfactory to distribute to the large population centers where this type of service work can be carried on economically, and where a sufficient supply is available for a volume movement through the stores in these areas. Point of sale advertising, we believe, is the only advertising justified at the present stage of the industry. This proves to the store manager that you are behind him and are helping him sell your product. Also, we are then sure that dates are actually for sale wherever the growers' money is spent. Methods for doing this are store demonstrations and point of sale advertising materials — including consumer booklets and in some cases adds run in the local papers in conjunction with that particular store's advertising.

Many ways of free advertising are available. Newspapers are anxious to obtain material for their different departments and will gladly cooperate. Also home economic programs on the radio are glad to help. We were able to get several free radio broadcasts east of the Rockies last year.

There is always competition in any line of business and so it is with dates. Due to the present limited area where dates may be grown commercially, there does not seem to be a possibility of overproduction, but we are faced with some competition from other products such as fancy pulled Calimyrna figs being sold at 12½c per pound and plenty of foreign dates at prices below those which we can afford to sell. Importations of foreign dates usually vary between 40,000,000 to 60,000,000 pounds per year. In 1939 there were forty and a half million pounds imported and in 1940 it increased to forty-four and one-fourth million pounds. The biggest problem in competing with foreign dates is the retail store owners. They know they can move a volume and make a profit with foreign dates, but to them California dates are an unknown quantity. In several instances last year, consumers demanded California dates when stores discontinued them in favor of the imports. There is only 1c per pound duty on imported dates, but since the war, prices have been going up. Also, there is that factor of uncertainty regarding future shipments. However, indications at the present time are that there is a large enough supply on hand to last the balance of the year. The worst competition in selling dates is price cutting on the part of cash buyers who contribute nothing toward market development, and who put out a cheap pack of poor quality This competition actually comes from among local growers who simply operate under the umbrella, and if it breaks, the cash buyer is the only one who can make a profit. The price of dates can be raised, as soon as sufficient outlets are developed and the market stabilized.

For three consecutive years there have been poor date crops and expenses of growing were hardly met. This put most growers in a position of having to borrow quite heavily. Several years back, most lending agencies did not consider the average date grower a good risk, unless he had other assets or income. Now, in spite of the partial crop failures of 1937, 1938 and 1939, governmental and private agencies consider a good grower to be entitled to credit. Since the organization of the present grower's marketing association, banks have found that they could depend on certain factors and felt that a sound future was being built. At the present time long term and crop loans are being made, as well as money being loaned to grower organizations for operating capital and cash advances to growers prior to the selling of the crop. Without this some $400,000 being advanced to growers, exclusive of crop loans, many gardens would have been hard pressed for operating cash. The main benefit obtained from such financing is that the grower does not have to obligate himself to some commission house or cash buyer, so that he loses control over the grading, pricing and disposition of his crop. If outside interests were to get control of this exclusive industry and the growers themselves could not control their own affairs, success would soon be a thing of the past.

As a final guide in national merchandising, sales quotas per grade are set up according to crop estimates. These quotas are set according to market surveys; as to the purchasing power and class of population, the number of stores and their different types, as well as by previous years experience. If any one district falls down in its quota, an answer must be forthcoming, and the situation remedied if possible. We have found that the movement of fruit is usually a direct reflection on the amount of personal contact made and the help we have been able to give the merchants. Selling today, must be constantly followed up and not allowed to lag as distributors, brokers and stores will only do what you make them want to do. California, and Los Angeles in particular, is the largest user of California dates. By the time dates have been advertised and markets developed in other districts as they have in Los Angeles, the per capita consumption will easily be increased. The one thing to guard against is permitting the new

markets to become as price conscious and to demand the lower grade of dates as has happened in Los Angeles. The Los Angeles market is close to the area of production and has always been a "dumping ground" for dates as well as other farm products. The only possible way to develop new markets in the proper manner is through a central marketing organization, directed by the growers for their mutual benefit.

The future of the date industry today is at the crossroads. If a concentrated effort of all growers is put forth in the right direction, the import situation, competition among growers, and price consciousness of consumers and store keepers can be licked. The price of imported dates is steadily going up due to the war situation which is going to be a big factor in enabling the California date grower to have preference shown to his product. The present tonnage is now sufficient to allow this program to be properly expanded at a very small cost per unit. Ground work has been laid in all phases of merchandising but it must be carried forward. Above all, only quality merchandise must be sold and it is vitally essential that the present Marketing Order for Dates continues.

And finally, in order for dates to be profitable, they must be grown and packed economically, and a good yield of quality fruit must be obtained. Last year some growers marketed between 12,000 and 15,000 pounds of dates per acre and made big money at the present prices. Others only marketed between 2,000 and 3,000 pounds per acre and were not able to pay expenses, It is quite obvious that there are two major problems facing most growers today; that of increasing production and reducing growing costs; and that of expanding markets and reducing distribution costs. In many cases, watching the operations of the date garden, will produce more profit than trying to raise the price of dates to the consumer. The date industry has now reached commercial proportions the same as any business and must be handled accordingly. The good farmer usually makes money in any field while the careless one cannot make money regardless of prices.

COMPOSITION OF DATES AS AFFECTED BY SOIL FERTILIZER TREATMENTS*

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Introduction

A cooperative experiment on the fertilization of Deglet Noor date palms was organized in January, 1935, and conducted in the adjoining gardens of James Arkell and Nelle C. Foltz, near Indio, California. The other cooperators were the California Date Growers' Association, Indio, and the University of California Citrus Experiment Station, Riverside.

The project was originally suggested by Mr. Arkell for the purpose of improving the quality of dates produced in his garden. A simple fertilizer experiment was undertaken, and 14 test plots were laid out in a block of six- and seven-year-old palms, according to a plan devised by L. D. Batchelor, E. R. Parker, and D. E. Bliss, of the Citrus Experiment Station.

Two test plots were used for each of five different fertilizer treatments and for each of two controls (A and B), which received no treatment. The duplicate plots were widely separated in order to reduce experimental error. All the 10 fertilized plots were supplied with nitrogen in the form of ammonium sulfate, each palm in 2 plots (nos. 3 and 11) receiving 40 pounds of ammonium sulfate annually and each palm in the other 8 plots receiving 20 pounds of ammonium sulfate plus 400 pounds of steer manure annually. Of the 8 plots, 4 (nos. 2, 7, 5, and 9) received, also, annual applications of 30 pounds of potassium sulfate per palm, and 4 (nos. 2, 7, 6, and 12) received 20 pounds of triple superphosphate per palm. Fertilizers and field labor were furnished by Mr. Arkell. At the time of fruit harvest, the dates from each test plot were picked, taken to the packing-house of the California Date Growers' Association, and graded separately.**

The Arkell date fertilizer experiment has been in operation for six years. Individual palms have been allowed to produce as much fruit as is consistent with good horticultural practice, and effort has been directed toward the elimination of alternate bearing. No attempt will be made in this paper to describe the experiment in detail or to draw conclusions regarding the relative merits of the different fertilizer treatments. It should be stated, however, that the investigation has received the undivided support of all the cooperating agencies.

Until September, 1940, no attempt had been made to determine the effect of the fertilizer treatments on the chemical composition of the dates. Annual records had been kept of the quantity of fruit produced in each plot and of its quality according to packing-house standards; but in order to ascertain whether chemical composition affected fruit quality as exemplified in these commercial grades, the suggestion was made that samples of dates from each test plot be analyzed to determine possible differences in their chemical composition. It is the purpose of this paper to report the results of analyses of dates from the crop of 1940.

Plot Yields and Commercial Grades

The fruit from the experimental plots was graded at the packing-house according to fruit-quality specifications of the United Date Growers of California (table 1).

The average total yield of fruit per palm, in pounds (figs. 1 and 2), was greatest in the plots receiving only ammonium sulfate and smallest in the untreated Control B plots. Of particular interest in connection with this phase of the subject are the comparative percentages of fruit of the various commercial grades

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**Recognition is given to Forrest Mathez and Arthur Cavanaugh, of the Arkell date garden, and to employes of the California Date Growers' Association, under the supervision of Donald Mitchell, for carrying out many of the details of the experiment.

TABLE 1

Grading of Experimental Fruit

Grades	Fruit-quality specifications*						
	Sugar, minimum per cent (dry-weight basis)	Moisture, minimum—maximum (per cent)	Weight of smallest fruit (minimum, in pounds)	Maturity	Imperfections† allowed	Color	Size
Standard:							
A (Extra Fancy)	68	20-25	1/40	Mature	None	Uniform	Uniform
B1 (Fancy)	68	20-25	1/48	Mature	Few scars or deformities; slight puffiness, checking, broken skin, dry end	Uniform	Uniform
B2 (Star Choice, Standard)	68	20-25	1/56	Mature	10 per cent per date	Uniform	Uniform
C (Dry)	68	‡....-20	1/54	Mature	Any except those interfering with hydration process	.....	.....
Substandard:							
D (by-products)	68	.....	.....	Mature	.....	.....	.....
Culls (nonedible)	68 or less§	.....	.....	.....	.....	.....	.....

*Adapted from: (a) Marketing Order for Dates, as Amended, August 25, 1939 (California State Department of Agriculture); (b) Grades for Dates Established by United Date Growers of California, June 11, 1940; and (c) sample grade separations as employed by the California Date Growers' Association, 1940.

†Imperfections include scars, deformities, puffiness, checking, broken skin, and dry end.

‡No minimum moisture requirement.

§There are two types of culls: (1) fruits with less than 68 per cent sugar; and (2) other fruits which are nonedible because of different types of spoilage.

from plots receiving different fertilizer treatment (fig. 2). With the exception of the dates from Control B plots, about one half of the fruit was classified in Grade B2, about one fourth in Grade B1, about one fifth in Grade C, and less than 5 per cent in Grades A, D, and culls.

Within the five fertilizer treatments, the differences in the percentages of packing-house grades were not very great. (These percentages should not be confused with the yield values shown in figure 1 and expressed in pounds, which varied considerably.) There was marked difference, however, between these percentages and those from the control plots, A and B, respectively. Control A plots had received two applications of manure prior to the beginning of the experiment; Control B plots had had no fertilization. It should not be inferred, however, that these previous treatments of Control A plots are entirely responsible for the differences in yields and grades of fruit from control plots A and B; and it should be observed that the relatively larger percentages of fruit of Grades C and D in Control B plots are offset by lower percentages of fruit of Grades B1 and B2.

Composition of Date-Fruit Samples

The analyses of fruit samples from the Arkell date fertilizer experiment included the usual determinations of moisture, dry weight, total soluble solids, insoluble residues, sugar, soluble solids not sugars, and total nitrogen.

Methods. — Random samples of mature orchard-run fruit (exclusive of culls) were obtained on October 12, 1940, at a stage in the harvest season when the largest pickings of dates were being made. These dates were brought to the laboratory and weighed after they had been wiped free of dirt and the calyxes had been removed. After the seeds had been extracted, the samples were finely ground in a meat chopper. Aliquot portions were then taken for the various analyses.

To determine moisture values, the samples were first heated for 1 hour in an oven at 100° C; they were then placed in a vacuum oven at 65° C and dried until the loss in weight amounted to not more than 3 mg.

The soluble solids were determined on known weights of fruit (without calyx and seed) by extraction on a water bath with successive portions of hot water until the readings of the refractometer showed the test solution to be free of soluble substances. All the extracts were combined and accurately diluted to 1 liter. Aliquot portions (100 ml each) were placed in weighed glass evaporating dishes and evaporated to near dryness on a water bath and finally dried completely in a vacuum oven at 65° C. The total soluble solids of the samples were calculated from this residue.

An attempt was also made to determine the content of soluble solids by measuring the refractive indexes in the water extracts with the refractometer and calculating therefrom the percentage of total soluble constituents. For some unknown reason, the refractometer readings on the water extracts indicated a percentage of soluble solids much in excess of the correct value, when compared with the percentage of soluble solids determined by the method described above or with percentages of other constituents of the fruit samples.

After all the soluble material had been extracted from the samples, the remaining water-insoluble portion was dried to constant weight in an oven at 103° to 105° C. This material was weighed, calculated, and reported as the insoluble residue.

The soluble carbohydrates in the samples were determined on the water extracts and are reported in terms of glucose as reducing and total sugars. The values for the total sugars (table 2) were determined on aliquots of the same water extract by both the Shaffer-Hartmann (8) and the Bertrand (3) methods. The comparative amounts

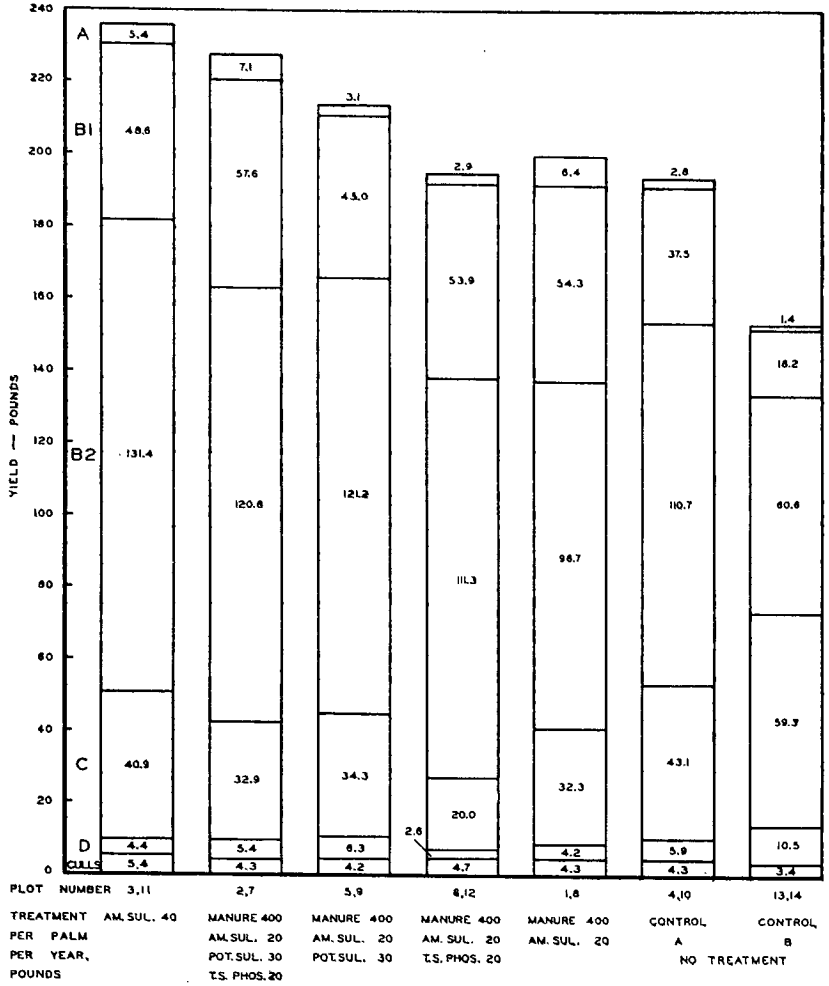

Fig. 1.—Histogram showing the average total yield of fruit per palm (in pounds) and the average yield of the different packing-house grades of fruit per palm (figures within columns) from plots of the Arkell date fertilizer experiment, crop of 1940. Yields from duplicate plots are combined.

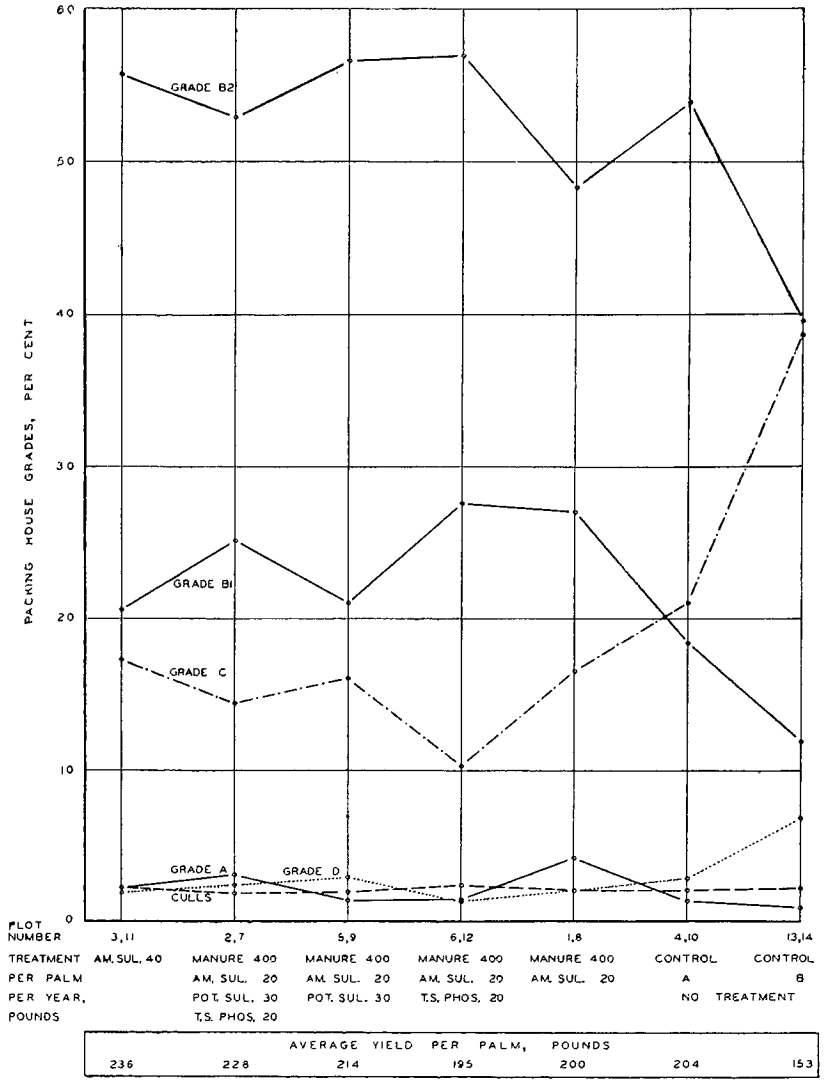

Fig. 2.—Graph showing the percentage of different packing-house grades of fruit from plots of the Arkell date fertilizer experiment and the average yield of fruit per palm (in pounds), crop of 1940. Yields from duplicate plots are combined. The data are arranged in order, from left to right, according to the relative market value of the fruit.

TABLE 2

Comparative Percentages of Total Sugars in Extracts of Date Fruits, Determined by the Shaffer-Hartmann and by the Bertrand Methods After Inversion of the Sucrose by Hydrochloric Acid or by Invertase.

Sample from plot No.	Percentage of total sugars determined by:							
	Shaffer-Hartmann method				Bertrand method			
	(Inversion by hydrochloric acid)		(Inversion by invertase)		(Inversion by hydrochloric acid)		(Inversion by invertase)	
	Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis
1	59.34	76.58	60.57	78.15	60.78	78.44	61.49	79.35
2	58.23	78.25	58.04	78.00	57.65	77.49	57.44	77.20
3	59.12	79.11	58.86	78.80	58.59	78.43	58.62	78.47
4	58.86	79.33	58.73	79.15	58.61	78.99	58.42	78.73
5	57.48	77.14	57.15	76.71	58.27	78.20	58.12	78.01
6	59.00	80.93	58.73	80.55	58.23	79.87	58.53	80.28
7	58.23	77.75	59.47	79.40	58.08	77.54	58.25	77.77
8	58.75	81.11	58.23	80.43	57.93	80.01	58.42	80.69
9	57.22	79.79	56.14	78.29	58.30	81.30	58.20	81.16
10	58.63	78.17	58.63	78.17	59.64	79.52	59.77	79.69
11	57.52	77.31	57.00	76.61	55.86	75.08	55.89	75.12
12	54.97	76.77	54.97	76.77	54.91	76.69	54.70	76.40
13	58.30	77.12	58.46	77.32	58.02	76.74	57.84	76.46
14	57.44	77.41	56.99	76.81	57.23	77.13	56.17	75.70

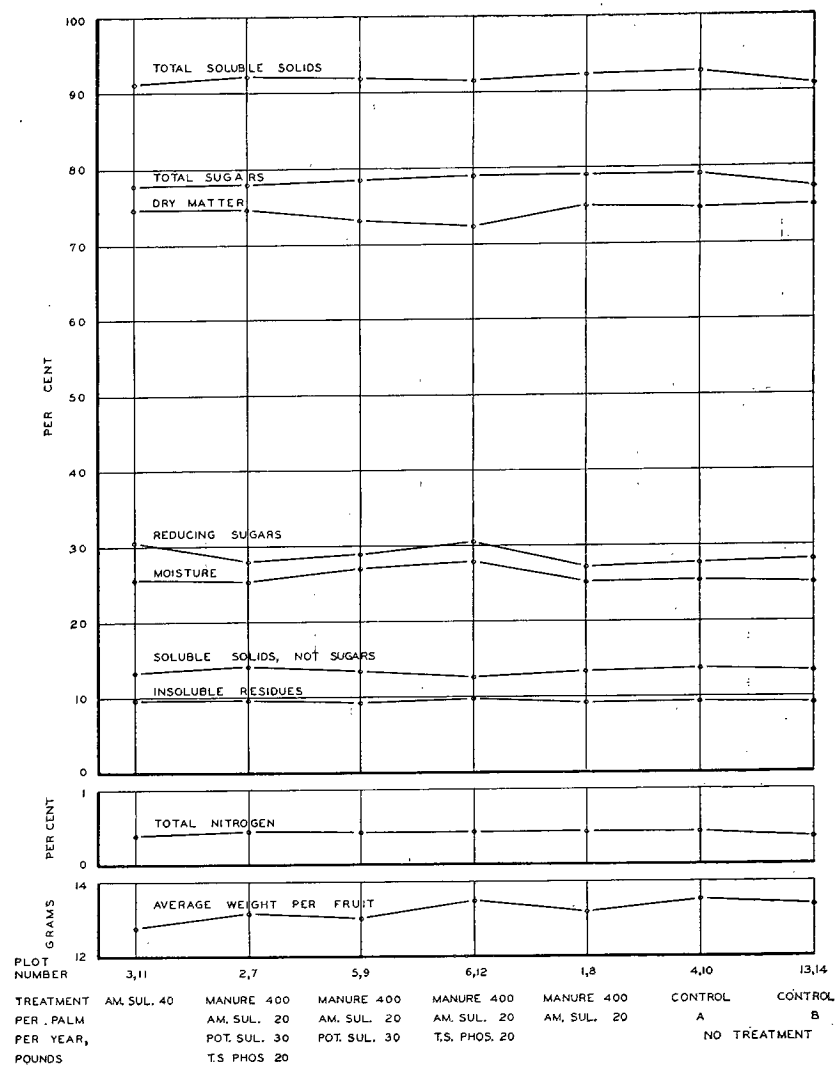

Fig. 3.—Graphs showing percentage composition of fruit samples and average weight per fruit (Arkell date fertilizer experiment). Moisture and dry-weight determinations are expressed on the fresh-weight basis; the others, on the dry-weight basis.

of total sugar obtained from the extracts by these two methods were determined by the action of hydrochloric acid at room temperature and by a highly active invertase enzyme. Results show that hydrochloric acid and the enzyme inverted nearly the same amount of sucrose in the extracts. This is good evidence that they hydrolyzed the same materials in the date to yield, within experimental error, the same values for the total sugars.

Total nitrogen was determined by the modified Gunning method (2) to include nitrate nitrogen.

Results.—The results of analyses of fruit samples are reported on the basis of fresh and dry weights (table 3) so that the influence of moisture on the percentage of constituents in the samples can be shown. These fresh-weight analyses permit the calculation of the data from a percentage basis to the basis of mass per average fruit. The distribution of the various solid constituents are indicated on the dry-weight basis.

The ranges of differences of the constituents in the samples (table 3) show the actual variations in the fruit. These small differences demonstrate the remarkable uniformity in composition of the samples from the different plots. Also, when the percentages of constituents are shown in relation to the fertilizer treatments (fig. 3), it may be seen that only small differences exist. It appears, therefore, that on the basis of these determinations on the fruit of the crop of 1940, little or no difference in chemical composition can be attributed to the effect of fertilizer treatment.

The results of these analyses are essentially similar to those reported by Haas and Bliss (6) and by Sievers and Barger (9), but include additional data on the total soluble solids, the insoluble residue, and the soluble solids which are not sugars. The differences between the total soluble solids and the total sugars ranged from 10.89 to 15.39 per cent on the dry-weight basis. After extraction of the soluble solids, the insoluble residues which remained varied from 8.94 to 10.02 per cent of the dry weight.

Relation of Composition of Date Fruits to Grades

A study of the factors involved in the commercial grading of dates (table 1) shows that the classification is based upon physical characteristics and general appearance rather than upon chemical composition of the fruit. There are two exceptions to this statement: the first is the limitation of moisture content in the various grades; and the second, the definition of the minimum concentration of sugar (68 per cent) on a dry-weight basis.

When the fruits of the various standard grades comply with the class specifications of minimum weight of smallest fruit in a particular grade and moisture content, it follows that under normal conditions of cultural practice, the sugar concentration should not be less than 68 per cent of the dry weight. It should not be concluded, however, that if two samples of fruit have the same moisture content, they also have the same content of total sugars on a dry-weight basis. This would be possible only if the total dry weight were soluble sugar, which is not the case; for, as shown by the data in figure 3 and table 3, the dry weight is composed of other soluble materials also. It is our purpose to emphasize here the fact that if fruits are classified according to the rules for the standard grades, especially according to the regulations for minimum weight and moisture, they will in most cases contain more than 68 per cent sugar on a dry-weight basis.

When the fruit is graded according to the specifications listed in

TABLE 3

Analyses of Fruit Samples from Plots of the Arkell Date Fertilizer Experiment

Sample from plot No.	Average weight per fruit, in grams	Moisture, per cent fresh weight	Dry matter, per cent fresh weight	Total soluble solids (per cent)		Insoluble residues (per cent)		Sugars (per cent)				Soluble solids not sugars (per cent)		Total nitrogen (per cent)	
								Reducing		Total					
				Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis	Fresh-weight basis	Dry-weight basis
1	12.89	22.5	77.5	71.27	91.97	6.97	9.00	19.65	25.37	59.34	76.58	11.93	15.39	0.32	0.41
2	13.17	25.6	74.4	68.39	91.92	7.35	9.87	22.32	30.02	58.23	78.25	10.16	13.67	0.30	0.41
3	12.41	25.3	74.7	67.22	90.00	7.47	10.00	22.66	30.33	59.12	79.11	8.10	10.89	0.29	0.39
4	13.81	25.8	74.2	69.31	93.40	7.09	9.55	23.37	31.50	58.86	79.33	10.45	14.07	0.30	0.40
5	12.58	25.5	74.5	68.31	91.69	6.93	9.30	20.39	27.37	57.48	77.14	10.83	14.55	0.32	0.43
6	13.62	27.1	72.9	67.15	92.11	7.31	10.02	21.97	30.13	59.00	80.93	8.15	11.18	0.31	0.43
7	13.07	25.1	74.9	69.03	92.16	6.99	9.33	20.05	26.77	58.23	77.75	10.80	14.41	0.34	0.46
8	13.39	27.6	72.4	67.10	92.67	6.75	9.32	20.86	28.81	58.75	81.15	8.35	11.52	0.31	0.42
9	13.38	28.3	71.7	65.91	91.92	6.63	9.24	21.70	30.26	57.22	79.79	8.69	12.13	0.29	0.40
10	12.28	25.0	75.0	68.86	91.81	6.87	9.16	17.71	23.61	58.63	78.17	10.23	13.64	0.33	0.44
11	13.66	25.6	74.4	67.67	90.95	6.87	9.23	22.65	30.49	57.52	77.31	10.15	13.64	0.29	0.39
12	13.32	28.4	71.6	64.96	90.72	6.65	9.28	21.94	30.64	54.97	76.77	9.99	13.95	0.29	0.40
13	12.75	24.4	75.6	68.50	90.60	7.14	9.44	19.96	26.41	58.30	77.12	10.20	13.48	0.27	0.36
14	13.94	25.8	74.2	67.53	91.01	6.64	8.94	22.12	29.81	57.44	77.41	10.09	13.60	0.25	0.34
Range of differences	1.66	5.9	5.9	6.31	3.40	0.84	1.08	5.66	7.89	4.37	4.57	3.83	4.50	0.09	0.12

table 1, the individual grade requirements are not rigid but are more or less elastic. From a practical standpoint this is the way it should be in order to care for the variations in quality and quantity of fruit from year to year. The use of such a standard for the commercial grading of fruit limits the utilization of the chemical composition, however, as an important factor in the classification of the better grades of fruit. For instance, a portion of the fruit in Grade B1 may sometimes be classed as Grade A fruit, and fruit of Grade B2 may occasionally be classed as Grade B1, classification depending upon the prevailing conditions of supply and demand or upon satisfaction of the requirement for the minimum weight of smallest fruit and maximum and minimum percentages of moisture, while samples of fruit from all three grades show practically the same chemical composition.

On the basis of the foregoing considerations, the moisture content is the chemical factor most directly related to fruit quality. It is safe to say that the physical properties and physical appearance of the fruit (broken skin, checking, wrinkles, puffiness, etc.) are most easily affected by changes in moisture. This factor has long been recognized by growers and packing-house managers as of prime importance in the grading of Deglet Noor dates. It is well known that increase in moisture accelerates the chemical reactions of an enzymatic and hydrolytic nature in the mature fruit. There is also a direct relation between moisture content and infection of the fruit by various fungi. Both fungi and bacteria produce souring and off-flavor in mature dates that contain an excessive amount of moisture.

Nixon (7) has demonstrated the relation of fruit-bunch thinning to the incidence of checking and blacknose. Haas and Bliss (6) and Aldrich and Moore (1) have investigated the influence of water on the injury of dates. Bliss (4) and Bliss and Bream (5) have emphasized the role of aeration of the fruit bunch in the reduction of fruit spoilage. The results of these investigations indicate that the quality of dates is closely related to the physical environment under which the fruit is grown and also to the type of bunch management used. Since the quality of the fruit is markedly influenced by these factors, it follows that the commercial grades are also affected. The data presented in this paper show the difficulty in evaluating the small differences in chemical composition of fruit that might be attributed to soil fertilization.

Summary

Chemical analyses were made on dates from the Arkell date fertilizer experiment to determine whether the fertilizer treatments had produced any effect on the chemical composition of the fruit. Although the fertilizers had influenced the average yield per palm, the differences in chemical composition of the fruit were very small. While the commercial grading of dates is based principally on the physical characteristics of the fruit, moisture content appears to be the most important property involved in fruit quality. Environmental conditions under which the fruit is grown and the type of fruit-bunch management employed are known to play an important role in the determination of fruit quality. There is as yet no evidence, however, that soil fertilizer treatments in the Arkell experiments are of importance in this regard.

Literature Cited

(1) Aldrich, W. W., and D. C. Moore. 1940. Relation of water supply by the date palm to water injury of the fruit. Date Growers' Inst. Ann. Rept. 17:3-5.

(2) Association of Official Agricultural Chemists. 1940. Official and tentative methods of analysis. 5th ed. XII+757 p. (See p. 27.) Association of Official Agricultural Chemists, Washington, D. C.

(3) Bertrand, G. 1906. Le dosage des sucres reducteurs. Soc. Chim. de France Bul. 35:1285-99.

(4) Bliss, Donald E. 1938. Spoilage of dates as related to management of the fruit bunch. Date Growers' Inst. Ann. Rept. 15:7-12.

(5) Bliss, Donald E., and Robert O. Bream. 1940. Aeration as a factor in reducing fruit spoilage in dates. Date Growers' Inst. Ann. Rept. 17:11-15.

(6) Haas, A. R. C., and Donald E. Bliss. 1935. Growth and composition of Deglet Noor dates in relation to water injury. Hilgardia 9: 295-344.

(7) Nixon, Roy W. 1935. Bunch thinning experiments with Deglet Noor dates. Date Growers' Inst. Ann. Rept. 12:17-19.

(8) Shaffer, P. A., and A. F. Hartmann. 1921. The iodometric determination of copper and its use in sugar analysis. II. Methods for the determination of reducing sugars in blood, urine, milk, and other solutions. Jour. Biol. Chem. 45:365-390.

(9) Sievers, A. F., and W. R. Barger. 1930. Experiments on the processing and storing of Deglet Noor dates in California. U. S. Dept. Agr. Tech. Bul. 193:1-23.

BRUCE SCOTT BOYER

1875 - 1940

* * *

The death of Bruce Scott Boyer on October 22, 1940, deprives California of one of its leading date growers. He was intimately associated with the date industry during the first twenty-five years of its commercial development. He was a quiet, practical man, who gained a thorough knowledge of date culture and unselfishly disseminated that knowledge among many who needed encouragement.

BRUCE SCOTT BOYER

John Boyer, his father, was a Union soldier in the Civil War and a farmer. It was on a farm near Terra Alta, West Virginia, that Bruce Boyer was born on January 17, 1875, the youngest in a family of nine. In 1882 the family moved to Salina, Kansas, where his mother, Jemima Turney Boyer, died seven years later. Because of various interruptions, he did not finish his studies in the public schools until he was eighteen years old. Later, as a boarding student in Mount Barbara Military Academy at Salina, he earned his tuition by waiting on tables. Shortly before he was to complete a course in commercial subjects, the school building was struck by lightning and burned; this disaster ended his formal education.

During the next twelve years he gained experience in several different types of occupation: he worked on farms and in a cigar factory and later followed the baker's trade. He came to California about 1897 and in the same year went north, intending to settle in Oregon. While enroute, he suffered from a severe attack of typhoid fever and malaria. This illness, together with an earlier attack of rheumatism, is thought to have affected his health in later years. In northern California he again found employment as a baker and then operated a small restaurant. A year spent in Salina, Kansas, was followed by a return to California in 1902 and association with the San Pedro Lumber Company at Huntington Beach. Early in 1907 he went to Chico where for three months he worked as an electrician with a gold-dredging outfit.

On August 14, 1907 Bruce Boyer married Clara Maria Christensen at the ranch home of the bride's parents near Garden Grove, California. About that time, he became interested in the agricultural possibilities of the Coachella Valley. This interest led to the purchase of 24 acres of land east of Thermal, and there for ten years he raised truck crops. During these years he was also bookkeeper for J. W. Newman of the Thermal Cantaloupe Growers' Union and served as president of the Board of Trustees of the Thermal School District at the time of the erection of the second school building. Mrs. Boyer taught for one year in the old school at Thermal and from 1914 to 1916, she acted as principal of the new school. The Boyers took much interest in dramatic performances given during this period by local talent in the Thermal district. These popular plays were staged with such meager facilities as coal oil lamps and very little scenery.

Mr. Boyer first became interested in date culture while living near Thermal and there he planted a nursery of seedling date palms. From this nursery originated the valuable male varieties called "Boyer Number 11" and "Cook Number 1." Three imported offshoots were purchased as an initial investment in palms of the standard varieties. These offshoots, planted deeply in an irrigation furrow, died from a rot of the bud. A propagation house with wooden sides and cloth roof was built to accommodate about 50 Deglet Noor offshoots imported from North Africa in 1914. A second lot of 25 Deglet Noor offshoots was purchased in 1916 and placed for a time in the propagation house.

The Boyers purchased 10 acres of unimproved land situated about one mile west of Indio, California, and in February, 1917, moved to this new location. The land was cleared and leveled, a well was dug, and date palms were transplanted from the farm at Thermal. Much trouble was experienced in the propagation of offshoots, for they were sometimes allowed to withstand prolonged exposure to desiccation in the air and sunshine before being placed in soil to strike root. One of the early methods of propagation involved the planting of young, unrooted offshoots in large pots made of terra cotta and filled only with stable manure. When a plan was discussed for supplying bottom heat for these potted offshoots, Mrs. Boyer objected and said that in her opinion nature intended that the offshoots should become rooted while still attached to the parent palm. Accordingly, soil was piled about the base of other young offshoots. They became rooted and, at a later time, were successfully established in the new date garden. This improved method of propagation, which was developed more or less simultaneously by several growers and experimenters, was revolutionary in its effect on the date industry. The acreage of date palms in the Boyer garden was increased gradually over a period of ten years until all of the area was planted. A new house was completed in 1925, and during the following years the Boyers displayed much skill and foresight in the management of their property.

Mr. Boyer took an active interest in the annual meetings of the Date Growers' Institute. In addition to his usual participation in the discussions, he once presented a manuscript* on the subject, "Date Protectors: What they are."

Mr. Boyer held several important positions in connection with the local date industry. In 1914 he served as County Horticultural Inspector for the Coachella Valley. He also worked with A. J. Shamblin under the Federal Horticultural Board on the eradication of the Parlatoria scale. The California Date Growers' Association was organized in 1919 and Mr. Boyer was one of the original members. He served as a Director in this organization until the time of his death, having held the offices as President, Vice President and Treasurer. He spent much time in the field conferring with members of the Association about the management of the fruit.

William W. Cook, President of the California Date Growers' Association, has written the following statement regarding Mr. Boyer: "He was a man who quietly went about his business accomplishing a great deal of good, both for his organization and for the date industry as a whole, to say nothing of his contribution to the good of the community in which he lived. We all regret his loss deeply as he was one man who could always be counted on to get a job done and not leave the troublesome details for someone else to finish up."

Mr. Boyer was known for his tact and for his ability in avoiding unpleasant entanglements in the controversies which, in early days, swept the Coachella Valley. He was a thoughtful man and one who anticipated the needs of his associates. Although he did not affiliate with any church, he expressed belief in the Christian principles and while living near Thermal attended the Baptist Church. At the time of his death he was a member of the Riverside County Farm Bureau and the Coachella Valley Lions Club.

Besides his wife, he is survived by two sisters, Mrs. Sabina F. Cary of Port Angeles, Washington, and Mrs. Alice V. Cary of Anza, California, by one brother, Gilbert V. Boyer of Yucaipa, California, and by several nephews and nieces.

I am personally indebted to Mr. Boyer as a friend and as a technical advisor. We were associated for more than nine years in studies on the fruit spoilage of dates. As a young, inexperienced investigator in the field of date pathology, I learned from him a great deal about the management of Deglet Noor fruit. His genuine interest in the possibilities of scientific research made him a splendid cooperator. I am only one of many friends who regret his passing.

DONALD E. BLISS
Citrus Experiment Station
Riverside, California

*Boyer, Bruce S. 1933. Date Protectors: What they are. Date Growers' Instit. Ann. Rept. 10:5.

BRYAN GANO HAYWOOD

1865 - 1940

* * *

BRYAN GANO HAYWOOD

Bryan Haywood was born in 1865 in a tall, narrow house on the lakeshore of Chicago. His father, Cornelius, was from England; his mother from the Southern family of Bryans of St. Louis.

When he was twenty years old he went to Colorado where he became engaged in gold mining for a short while. Following this he gained his first business experience in the Higgins Sporting Goods Store which later became the Haywood Arms Company and then Haywood-Spaulding Arms. After selling his interest in the sporting goods business, he moved to Kansas City where he became established in the business of handling and selling alfalfa.

During the world war he was placed in charge of the Red Cross work at Camp Pike in Arkansas, then the largest camp in the country.

In 1922, he retired from active business and settled in California. He became interested in farming and in 1923 his first connection with the date industry began when he purchased a five-acre garden two miles west of Indio. This was named the Model Date Garden and Mr. Haywood put all his enthusiasm into growing the largest crops of best quality dates possible. He used water and fertilizer vastly in excess of the quantity customarily used by other date growers at that time. He also thinned the fruit bunches more than was the common practice. By this method he produced tonnage yields per acre which had not been thought possible up to that time. This production of high yields and high quality dates gave the first impetus to the standard of production and quality that the California date industry now holds as an ideal.

His later connection with the date industry was chiefly with handling and marketing of dates. From 1928 to 1930, he served as president of the California Date Growers association. In 1937 he took an active part in the formation of the United Date Growers. He served on the board of directors of this organization and was actively engaged in its affairs until his death which occurred on December 13, 1940.

He was an individualist with positive opinions which he never hesitated to express. During the latter years of his life he worked hard to bring about a better understanding and cooperation among date growers. His passing is a great loss to the entire date industry.

AFTERNOON SESSION

Chairman, Howard Miller, Manager of the Agricultural Department Los Angeles Chamber of Commerce

IMPORTANT FACTORS IN THE COST OF GROWING DATES

By H. B. Richardson, Assistant County Agent, Riverside County

At the Sixteenth Date Institute, I reported in detail upon some of the costs necessary for the proper maintenance of a date garden. It is not the object of my talk this afternoon to go into any of these details, but to point out some of the important factors which have come to light through this study. I would like to say that the Sixth Enterprise Efficiency report has just recently been completed, copies of which are available, to anyone interested, at the Agricultural Extension Service office, Post Office Building, Riverside.

We are not going on with the study at this time as much data have been accumulated on production costs. At a future date, should the industry feel the need of new and up-to-date figures, the study could be resumed provided sufficient date growers would be willing to cooperate.

The final report has a number of tables which will be interesting to those who contemplate going into the date-growing business as well as to those who are now growing dates. The table on general summary of gardens by age groups, based on the records from 1934 to 1939, inclusive, gives some idea of the relative costs through the beginning years. Several date growers have been in the study since the start. Their records are tabulated as six-year averages for those gardens. These records show some variation in costs, but not as much as you would think. Growing and harvesting costs amount to a low of $4.04 per hundred pounds to a high of $4.62 per hundred. It is interesting to note here that growers have long said that it costs about five cents a pound to produce dates. It would seem that this figure of five cents has been substantiated as not far out of line by this study. There are several other cost tables based on estimates and actual figures submitted, together with a table on depreciation charges and palm tree values. The last table is perhaps the most interesting and brings together the best figures we have been able to get from the yearly reports. I would like to mention a few of the standards from this table. It shows a total cultural labor charge of $61.35 and a picking and hauling charge of $61.50, or a total labor charge of $122.85 per acre. The material cost is about $63.00 per acre and cash over-head about $29.30, or a total cash cost per acre of $215.65. With a charge of $61.50 for depreciation and $37.25 for interest on investment, it totals $314.40 per acre as the approximate cost of producing an 8,000-pound crop of dates, or slightly less than four cents a pound. I am of the opinion that careful study of various items by growers will enable them to make substantial savings and reduce the $314.40 per acre total cost.

With rather low returns to growers during the last few years, it is hard to see how one would make a satisfactory living from 10 acres of dates. If the grower could average 6½ or 7 cents a pound for orchard-run fruit with 4c per pound costs and a production of 10,000 pounds per acre or over, 20 acres or even less would return a good living. Averages are all right to consider and study. They are necessary figures for any industry but the grower should strive to produce crops above the average and keep his costs as far below as possible. What's more, some of the growers are doing it!

There are many factors which can influence the cost of growing dates, some of which are under the control of the operator, others are not. The weather conditions at harvest have damaged some of the recent crops. The freeze of 1937 reduced one crop and affected the next. These reductions are all reflected in the cost study yield per acre figures which are probably not typical of future date garden yields. The data on production costs should not be far off as some of these charges have been very constant right through the report. I would like to say another thing for the benefit of those who are not too deeply involved in the date industry at this time, and that is, the growing of dates is no more a "sure-fire" big profit business than any other agricultural enterprise. The same care, ingenuity, and managerial ability are needed in this industry as in any other. There are growers who are making good returns on invested capital based on present-day values and not on the historical past. These same growers are applying every-day common sense without any attendant "hocus pocus" and the conditions of their gardens show the results.

There are two things which seem to influence more than any others the success or failure of a date garden. One is yield and the other is the quality coupled with price per pound for the product. There is not a great deal that the individual can do about the price except through cooperative action, but by sound cultural practices, he can influence the yield and quality.

Soils, perhaps as much as any one thing, influence the quality and yields. You have all seen the removal of date palms from the heavier soil types where production has proved unprofitable, and if we analyze the reason, we find that heavy soils in some parts of the Valley are unsuited to the production of dates. This was not known 20 years ago when the industry was young. Lack of water penetration, with the resultant large percentage of small, shriveled, and dry fruit forced the operators to abandon the enterprise. You cannot take a poor soil and bring it up to equal that of a good soil. You can, however, maintain a good soil by proper care and fertilization. You cannot build up a poor piece of ground to a state of high productivity. The study indicated the necessity of locating a garden on uniform, deep, open, and well-drained soils. There are areas of these soils in the Coachella Valley and they should be used for date growing. Land should be properly prepared, leveled and the irrigation system installed for the operation of as near a flooding system as possible. Variations of soil are always

noticeable to the operator in the handling of irrigation water. The uniform distribution and penetration of water is desirable for best results.

Water and Irrigation: The cost study shows a wide variation in individual costs as well as amounts of water applied. The average yearly application for all gardens in the study is about ten acre-feet per acre. The cost for power to pump this water is between $30 and $35 per acre. The labor cost for irrigation fluctuates widely, due, I believe, to including under this heading several other items. The average labor costs for the six years varied from about $9 to $15 per acre per year. At the Fifteenth Annual Date Growers' Institute, Arthur Pilsbury reported upon his studies on the use of water by date palms. These studies indicated that date palms used about seven acre-feet of water per year and that to maintain this amount in the root zone there was applied on an average of nine acre-feet to the gardens studied. This would indicate that the average in his investigation is not far from the data obtained in the cost study.

Cover Crops: Most growers reported a charge for the growing of cover crops in the date garden. The use of cover crops in date gardens is a soil-building practice which is well adapted to local conditions. The growing of these cover crops in the winter months is not to be questioned, but the production of large amounts of green organic matter for incorporation in the soil during the summer months should be closely watched. Many times growers have allowed these crops to mature before discing them down. These crops should be disced under in the bud stage before they become woody. To grow any large amount of green organic matter in the date garden, it must have water above the requirements of the palms alone. The amount of water necessary for both the cover crop and the palms is not always applied. Date growers growing summer cover crops should be prepared to meet adequately the water requirements of both the cover crop and the date palms. If insufficient water is applied, the date palms may suffer and this will result in a loss of crop quality.

Fertilizers: There is little definite experimental information available about the fertilizer requirements of the date palm. Work is in progress by the Citrus Experiment Station and U. S. Department of Agriculture which may give us a better picture of the fertilizer requirements of the date. The cost study shows that growers have spent on the average about $25 per acre per year for fertilizer materials. A review of what these growers used showed a wide range of mixed fertilizers and manures as well as different soil amendments. There is no one consistent practice which has been carried on continuously throughout the six-year period. It is well to note that at some time or other, if not regularly, growers have applied varying amounts of manures. It would appear from the experience with other crops that the use of manures which supply most of the essentials of plant growth is a desirable and sound practice. It is indicated that the heaviest users of manures seem to have the highest yields and the best quality crops. The proper amount per acre to apply needs further study. Nitrogen seems to be the limiting element and most necessary in successful crop production in the Valley. The study emphasizes the need for more information on this problem. Of four gardens which have been in the study for six years continuously, the range of expenditures for fertilizers varied from a little over $17 to a high of over $41 per acre, yearly average. The average yields from these gardens have been well up toward 10,000 pounds of fruit per acre per year, a good record, considering the years involved.

Labor Costs: The date grower does not need to be told that he has a very high labor charge per acre. This charge is comparable to many of our hand-labor crops. The study shows a wide range in labor costs. This wide variation is a place where the operator can give more careful attention to his expenditures with a view toward eliminating or reducing some of these charges to the minimum. The last years of the study show a variation from a low of $56 per acre to a high of $96 per acre for cultural labor. Cultural labor, which means the amount of labor necessary to mature a crop on the palm. This does not include harvesting labor. Obviously, somewhere in between these two extremes lies the proper amount to expend. The combined total cash costs indicate that to produce a crop on the palms in 1938 was $175 per acre and in 1936 was $252 per acre. Somewhere between these figures is probably the correct expenditure. Harvesting costs have fluctuated with the crop. The labor cost is high, but unless more economical methods of getting the dates off the palms can be found, there is not much that the grower can do toward cutting his costs. I believe it is of interest at this time to call attention to a recent release from the Giannini Foundation of Agricultural Economics, University of California, in which it is pointed out that the California date should find a favorable market during the coming year, due largely to increased purchasing power of consumers. The domestic date industry has not been affected by the war and the rising national income due to the defense program is creating a favorable market for dates. If foreign supplies now coming into this country were to be cut off, prices would, no doubt, rise considerably. I call attention to this for one reason: with a high labor requirement for date growing, with rising labor costs all along the line, the date grower will no doubt have to pay more for his labor and this will off-set his increased returns. Date growers should therefore continue to study more carefully their individual labor requirements with a view to making reductions wherever possible.

An old "farmer" friend once remarked that it took three H's to produce a crop of oranges: Horse sense; Horse power; and, Horse manure, all of which are the production of stable thinking. Perhaps he is right! I see no reason why the same H's cannot be applied to dates as well as to oranges, with principal emphasis on the first H.

I wish to express my appreciation to those date growers who helped make the study possible.

SECURING HIGHER DATE YIELDS AND IMPROVING QUALITY

Date Growers Discussion Panel

Discussion Leader: H. L. Cavanagh
Date Grower

* * *

There is a marked difference in the tonnage of dates produced by gardens of the same age throughout the date growing section of Coachella Valley. Part of this difference in yield is due no doubt to location and soil conditions. It does not seem, however, that it is all due to these factors as there are date gardens producing high yields in almost every section of this district. These high yield date gardens also produce dates of good quality.

The object of this discussion is to give the operators of date gardens producing high yields an opportunity to describe their cultural practices, their methods of thinning, fertilizing, irrigating and any other factors which appear to them to influence the yield and quality of dates. It is hoped that from such presentation of facts other growers will, by adopting similar methods, be able to increase the per acre production of their date gardens and also improve the quality and size of individual dates.

The growers whom you will now hear take part in this discussion have been requested to place special emphasis upon any operation which is considered of particular importance in the production of good quality dates, together with high average yields.

In listening to these discussions date growers should bear in mind the variable conditions under which dates are grown and that good judgment must be exercised to find the cultural methods most suitable to each individual date garden. Proper cultural methods together with good management will in most instances produce the desired results.

The following schedule will serve to illustrate the importance of securing high yields of quality dates.

Annual per acre cost of date gardens with average yield and average quality dates:

Fertilizer	$ 25.41
Irrigation	36.91
Cultivating, etc.	78.29
Harvesting	46.10
	186.71
Gross return per acre from sale of dates	277.36
Net cash return per acre	$ 90.65

Annual per acre cost of date gardens with high yield and good quality dates:

Fertilizer	$ 40.00
Irrigation	33.00
Cultivating, etc.	139.00
Harvesting	88.00
	300.00
Gross return per acre from sale of dates	600.51
Net cash return per acre	$300.51

By S. D. Overholtzer

No two date gardens are situated on the same type of soil and no two gardens receive the same general cultural treatment, particularly in respect to fertilization and irrigation. In this report I am attempting to give my own experience and methods which I found most successful in producing good quality dates as well as high yield per acre. Care should be exercised in drawing definite conclusions from methods described herein as the same results might not be obtained under different conditions.

In the first place the soil on which my date garden is located is sandy with an occasional thin layer of silt. I have never found the upper layers of silt to be more than one or two inches in thickness. At a depth of about ten feet, however, there is a silt layer at least two and one-half feet in thickness. Beyond this depth I have not tested the soil and know nothing of conditions existing at lower levels.

For a cover crop Hubam clover is planted in my date garden about the first of January and is plowed under about the first of May. This cover crop is irrigated as often as necessary for good steady growth. During the winter and early spring irrigations are necessary about once a month but in late spring it is necessary to irrigate more often, sometimes as frequently as every ten days. After the cover crop has been worked into the soil, the date garden is irrigated every ten to twelve days. During harvesting time the garden is irrigated as often as appears necessary according to weather and soil conditions. In some cases an irrigation is given every ten days and in other cases not for three weeks.

In addition to the use of cover crops for fertilizer, steer manure is also used. None was applied last year, but in the preceding year ten tons per acre of steer manure had been applied in the month of December.

After pruning the palms, all date leaves are put back into the soil, none are hauled out or burned. The leaves are ground rather fine and thoroughly worked into the soil between irrigations.

Commercial fertilizer also is usually applied about the first of May at the time the cover crop is being worked into the soil. This consists of 400 pounds per acre of 16-20 and 400 pounds per acre of potash.

The date garden is kept free of weeds from May to January by thorough cultivation after every other irrigation.

One very important factor in producing good quality dates is proper thinning of the date bunches. My plan is to have all thinning finished before the pits begin to harden. I leave 20 to 25 strands to each bunch with 35 berries to the strand allowing for a drop of 5 berries from each strand. This of course makes it necessary to leave sufficient bunches on each palm to produce the desired yield.

By Hawley O. Duncan
Supt., Model Date Garden

Basing our opinion on many years of actual experience in handling and growing dates, we have definitely come to the conclusion that date gardens will, under favorable conditions with proper care, produce dates of good quality together with high yield per acre. The following is a description of the cultural methods used in handling the Model Date Garden.

The soil on which this garden is located is a fine sandy loam.

For a period of several years, ten to twelve acre-feet of water have been used per year. During the season of hot weather, the garden is irrigated every fifteen to twenty days. Tests with a soil auger are made regularly at least once a month. If it is found that the soil is not wet enough, an irrigation is applied regardless of time schedule. During harvest time the use of water is sharply reduced and almost eliminated during cool weather.

When the harvesting of the dates is completed and the palms are pruned, the garden is fertilized.

For several years the Model Date Garden has had from eight to ten tons of sheep manure applied annually per acre in addition to the use of various amounts and kinds of commercial fertilizer. Alternately, Sulphate of Potash and Sulphate of Ammonia was used one year each, and mixed fertilizers 0-10-12 and 0-20-20 two years each. In our case 0-20-20 appeared to give the best results. Ordinarily about six pounds of this fertilizer was used per palm. In 1940, no sheep manure was used, but instead forty-seven pounds of 0-20-20 was applied to each palm with good results.

For a cover crop, melilotus is generally used. The seed are planted immediately following the application of the manure, after which the soil is thoroughly irrigated. The cover crop is plowed under and worked into the soil during the latter part of April.

Clean cultivation is generally practiced but at times weeds and grass (not Bermuda) are allowed to grow to full height before cultivation. From the time the cover crop is plowed under until harvest, the garden is cultivated about once every two months.

Methods of thinning and tieing the date bunches early in the season is an important factor in producing high quality fruit. At the time of pollination it is our practice to cut the blossom strands approximately in half depending on the apparent strength of the blossom and stem. After pollination the bunches are pulled down below the leaves and tied. Enough low-hanging leaves are cut from the palms so that the bunches will hang clear. This early tieing holds the bunch down when it is not heavy enough to be held down by its own weight and later in the season the same tie will hold the bunch up when it is heavy and will in most cases prevent the fruit stem from breaking.

At the same time of this tieing operation the date bunches are thinned. This is done by cutting out the center of the bunch and removing strands until 900 to 1200 berries are left, depending on the size of the stem and bunch.

The importance of early and heavy thinning cannot be overemphasized. All date bunches should be thinned in accordance with the size and strength of the fruit stem so that each individual date will be supplied with sufficient water and food at all times. At the time of maturity such dates will be large and usually good quality also.

Thinning can, of course, be carried too far. When the bunches are thinned too severely the quality of the dates will be lowered and the quantity reduced.

The average production of the Model Date Garden is 14,000 pounds per acre. In 1937 the production was 345 pounds per palm or 16,560 pounds per acre.

DATE PRODUCTION METHODS

By E. L. Jarvis and Eugene C. Jarvis

This is a joint report for Mr. E. L. and Eugene C. Jarvis and is based on our present plantings of Deglet Noor variety dates that were started in 1921 and continued through 1938.

In looking over past records, we have come to the conclusion that, in order to get the most possible out of a garden, one must actually know every foot of it. By that, we mean soil conditions and palms vary so much that a standard program of cultural methods cannot be followed throughout. Some parts of the garden require more water and certain palms require special methods of thinning. The condition of the palm is really the determining factor and can be determined by the amount of new growth and number of leaves on the palms.

Our soil is well adapted to date culture on the average, varying from blow sand to silt. The best production always comes from the lighter soil after it has been built up. Poor quality fruit and a low yield is always the case on heavy type soil.

Our land has been graded and the irrigation handled so that there is no waste water and on the average ten acre feet of water is applied per year. The garden is irrigated after picking is finished in the fall and thereafter about once a month until pollinating is under way. From that time until hot weather it is irrigated about every three weeks. After that a two-week schedule is followed until the extremely hot summer weather is past. Irrigation during the picking season varies, depending upon the condition of the fruit as it is picked. In dry years we irrigate after every picking. We use the flood system and do not have cross checks as each field is practically level as far as the flow of water is concerned.

In our fertilizing program manure is used almost exclusively. Before the freeze in 1937 we applied about ten tons of barnyard manure per acre in the fall and supplemented this with potash and super-phosphate in the spring when the cover crop was disced under. Since that time we have used steer manure almost exclusively. The average analysis varying between 2.47% and 3.39% of potash; 1.46% and 1.99% of nitrogen; and .83% and 1.20% of phosphate; and 58.23% to 68.14% organic; and 10.6% and 23.46% of moisture. Other plant food is also obtained in the manures, and we feel that it is a better balanced program as the three main elements seem to be in the right proportions. The fertilizer is usually applied between December and February. There have been many theories and ideas on the requirements of the date palms, but we believe, when in doubt use steer manure as you get a little of everything.

Cover cropping appears to be one of the best methods of building up sandy soil, and therefore we have grown Hubam Clover in our garden for a number of years. We usually plant in December and turn it under in May. Lately, the cover crop has not been doing well in the old gardens as the weeds seem to do better in the partial shade and crowd out the clover.

It seems important to us to take good care of the young palms and we always place about 200 pounds of manure in the hole before the shoots are planted and grow cover crops for the first five years. From then on, we stick mainly to steer manure and supplement the weaker palms with commercial nitrogen. We believe in cleaning all off-shoots from the palms by the fifth year and then force production of fruit.

After the cover crop is disced under we cultivate only as often as is necessary to keep the weeds from going to seed, but try to keep the ground as clean as possible after the dates start to color. Particular pains are taken to keep all pests, such as Bermuda grass, out of the garden. It costs less to keep it clean than to try to control it later on.

In order to develop a date garden capable of producing high yields, it is necessary to take good care of the palms during their non-bearing period.

Proper thinning and bunch management is also necessary in order to get good production of quality fruit. The basis of thinning is the relative size of the fruit stem of each individual bunch. Generally

speaking, thinning is started the middle of May and each bunch is thinned to approximately 30 threads with 30 to 40 berries on each thread. Bunches so thinned will average close to 20 pounds picked weight. We always cut off the real early and late bunches, as they usually are the weakest. Our thinning is watched very closely and we count the threads on every bunch as well as the individual dates on at least one or two threads on each bunch.

In 1932, accurate records were kept on the yield of palms of different ages. Palms four years old produced an average of 24 pounds per palm; five years old, 90 pounds; six years old, 115 pounds; seven years old, 200 pounds; eight years old, 270 pounds; and ten years old, 375 pounds. The yield per acre for 1932, based on the above figures ranged from 1,200 pounds for four years old, to 18,750 pounds on ten year old palms. The freeze of 1937 and 1938 and the rain damage of 1939 more or less disrupted our yearly averages. Last year, the average picked weight per acre on one twelve-acre block was 12,000 pounds. This block included light soil and also two acres of hard soil a clay strata 18 inches down. A two-acre block of light soil produced 14,000 pounds per acre. The percentage of grade out on the twelve-acre block is as follows:

X Fancy, Fancy	7%
Star Choice	38%
Standard	24%
No. 1 Dry	20%
Substandard	7%
Culls and shrink	4%

The average grade out on the two-acre block is as follows:

X Fancy, Fancy	7%
Star Choice	48%
Standard	13%
No. 1 Dry	24%
Substandard	5%
Culls and shrink	3%

Past records, up until the time of the freeze, showed an average production on the better soil of between 15,000 and 18,000 pounds per acre. As the acreage increases, less individual care can be given and the yield per palm begins to drop.

Our per acre cost of production for 1940 is as follows:

Labor (25c and 30c per hour)	$127.32		
Tractor and driver at $1.75 and $1.00 per hour	20.35		
Fertilizer-Steer manure at $5.00 per ton	70.00		
Bags, Twine, Sulphur	12.28		
Water	12.00		
Hauling	12.00		
Taxes	18.83		
Miscellaneous—Tool and Labor	4.00		
Total cash expenses per acre	$276.78	$276.78	
Total cash expenses per pound			.023
Depreciation on palms at 3% on $2,000 valuation, including well and pipeline	60.00		
Interest on investment at 2% on $2,000	40.00		
	100.00	100.00	
Total costs per acre		$376.78	
Total cost per picked pound			.0311

Our total per acre income, based upon returns from United and C. V. D. G. to date, and assuming that the 20% unsold portion will not bring quite as much as the sold portion, is as follows:

10,680 lbs. of Standard grades	$875.76	or 8.2c per pound
840 lbs. of No. 2 Dry	39.90	or 4.75c " "
11,520 lbs. Total	915.66	Total cash
480 lbs. Culls & shrinkage	230.40	Grading charges actually paid
12,000 lbs.	$685.26	Net return per acre to ranch
	.0571	Net return per pound on picked weight

SUMMARY

Total income per acre to ranch	$685.26
Total costs per acre including cash disbursements, depreciation, and interest on investment	376.78
Net management income per acre	$308.48
Gross income per picked pound	.0571
Total costs per picked pound	.0311
Net income per picked pound	.0260

These figures are based on the fiscal year of January 1st to December 31st, covering actual expenses for the year 1940 and income already received from the 1940 crop and estimating that the returns not yet received will average slightly less per grade unit than already received.

BEARING CAPACITY OF DEGLET NOORS IN TERMS OF FRUITS PER LEAF

By Forrest Mathez

At the Arkell Date Garden all palms are Deglet Noors. The garden is located eight miles westerly of Indio, on Highway 111. The soil is a fine sandy loam, carrying a small amount of clay.

Accurate figures on the amount of water used are not available, at this time. The average will be close to fifteen acre feet, per acre per year. During the winter, water is applied often enough to keep the sub-soil moist, with maximum intervals of six weeks between irrigations. About April regular irrigation is started with about three weeks interval between irrigations. As warm weather begins, the interval of irrigation is cut down. During the hot weather water is applied every seven to ten days. Regular irrigation is not suspended until the weather cools.

In conjunction with the College of Agriculture, a fertilizer experiment is being carried on, covering 195 palms.

On the remainder of the producing acreage, 7½ tons of manure per acre per year are applied in one treatment, on the more sandy portions. Ten pounds of ammonium sulphate per palm per year are applied to all palms; one-third in April; one-third about June 10th; and one-third about July 26th. A cover crop of hubam clover is planted on this acreage about the end of November Leaves are disced in with the cover crop and the ground is disced each time that amonium sulphate is applied.

A detailed study of the bearing capacity of the Deglet Noor in terms of fruit per leaf is being made. But it has not been until the last two years that real progress has been made. The object of this study is to develop a standard method of thinning bunches in the Arkell Date Garden so that it may be applied to all palms in this garden. Although this study is far from complete, in

order to stimulate interest, and in the hope that information obtained may be helpful to growers who are suffering from alternate bearing of their palms. The following information has been developed from the Arkell Garden. These results are taken from the 1940 records.

In this study, the term bunch is not used as a unit of quantity. It has been found that bunches may vary in number of fruits retained on a bunch from 288 to 1406 fruits per bunch; and from 5 to 28 pounds in weight. In considering quantity, the individual fruit or the pound is used as the unit And when considering capacity to bear, either the number of fruits per leaf; number of fruits per palm; pounds of fruit per leaf; or pounds of fruit per palm, is used as the unit of quantity.

Table No. 1 gives results obtained in 1940 Column No. 1 gives the number of the line on which data concerning various subjects are given. Column No. 2 gives the item considered. Column No. 3 gives prices per pound, in cents, of various grades of fruit listed. Columns Nos. 4, 5, 6, and 7 give various test plots considered. The items listed will be discussed in accordance with the line number on which they are listed.

Line No. 1: Gives the average number of pounds of fruit per palm shipped to the packing plant. Pounds per palm were calculated from total weight shipped from each plot.

Line No. 2: Gives pounds of "A" grade fruit, in accordance with California Date Growers Association standards, in columns 4, 5, 6 and 7 Column No. 3 gives the price per pound. net returns to the grower, paid by the California Date Growers Association on 1930-40 crop returns

Line No. 3: Same as above on B-1 grade fruit.

Line No. 4: Same as above on B-2 grade fruit.

Line No. 5: Same as above on C grade fruit.

Line No. 6: Same as above on D grade fruit.

Line No. 7: Same as above on Cull grade fruit.

Line No. 8: Gives average values of fruit per palm. calculated from above figures. California Date Growers Association prices for the 1939-40 crop were taken because they are the only prices available for grades given. Until such time as packing house grades become standardized and prices become stabilized, it will be quite impossible to give accurate values based on grades and prices, for all growers to compare. But it is possible to determine value per palm as a standard of comparison. With this fact in mind these figures are submitted. Note that the plots bearing the greatest weight of fruit per palm also have the greatest value per palm.

Line No. 9: Gives the average number of functional leaves per palm. The number of fully developed leaves on each palm is estimated. To this was added 15 leaves, as an allowance for the functional value of "heart leaves." Those leaves whose thorns, at the base of the leaf, are completely exposed above the fiberous growth are destined as "functional leave." Leaves in the crown of the palm that do not meet this requirement, are designated as "heart leaves." The functional value of 15 leaves for the "heart leaves" is arbitrary and remains to be determined more accurately. With practice, one man can estimate the leaf growth on 40 to 50 palms of this size per hour. The limit of accuracy should be within 5%.

Line No. 10: Gives average number of fruits per leaf that were allowed to remain on the palms, after thinning, in 1940. It is assumed that the fruit yields, expressed in pounds shown on Line No. 1, is the correct load for these plots in 1940; and that the number of fruits retained is correct to give the best results with grades as shown on Line Nos. 2 to 7, inclusive. Note that it required a different number of fruits per leaf, in each test plot, to obtain these results. The estimating of fruit on these palms is probably more accurate than is necessary in common practice, but could be done if results are found to warrant it; 1940 was a lay-off year for all these palms. At the time of pollinating, the ends of the bunches were cut off and some strands were cut out of the center of some of the larger bunches. Pollinating bunches was performed by use of a puffer and tieing three strands of the male blooms into the bunch. when male spathes were obtainable. When male spathes were not obtainable, cotton was dipped in pollen and tied into the bunch. in lieu of strands of the male bloom. At the time of thinning, bunches were limited to a maximum of 1406 fruits per bunch. The palms were limited to a maximum load of 125 fruits per leaf. No minimum requirement was placed on either a bunch or a leaf. Bunches carrying as little as 288 fruits were retained. No effort was made to keep the same number of bunches on each palm, or to keep the bunches a uniform size. The number of fruit strands per bunch varied from 24 to 54; and the number of fruits per strand varied from 12 to 36; while the number of bunches retained on the various palms ranged from 10 to 14. Except to cut off poorly pollinated and deformed bunches, no thinning was done, other than to meet the above requirements. Due to the fact that all these palms were suffering from alternate bearing and in the lay-off year, combined with the fact that there was a heavy drop and poor pollination of the fruit before thinning, there were very few of the palms that carried the maximum load of 125 fruits per leaf. The average of each of these plots was below that figure. However, after a detailed investigation, it appears that with this thinning practice, all palms will bear the maximum of 125 fruits per leaf this year.

Line No. 11: Gives 125 fruits per leaf as the estimated load a palm can bear. This is an arbitrary value It is hoped that through this project a more accurate figure will be determined. But at best, there will be a considerable difference in value for individual palms, and for the varying conditions under which they grow. This year with all palms carrying 125 fruits per leaf, there will be an opportunity to observe: (1) Whether yield is increased in terms of pounds per leaf. (2) effect on number of fruits per pound. (3) Effect on grade of fruit. (4) Effect on value of fruit, based on 1939-40 prices.

Line No. 12: Gives a comparison of values of figures on Lines Nos. 10 and 11, expressed in percentage. The drop of fruit in 1940 was beyond our control, but the values here shown express in part, at least, the price paid for improper thinning in 1939.

Line No. 13: Gives the average number of fruits retained per palm. It is estimated at the time of thinning and is probably more accurate than is necessary in common practice.

Line No. 14: These figures are calculated by dividing the number of fruits given on Line No. 13 by figures given on Line No. 1. They show the number of fruits left on the palm at the time of thinning that it took to make a pound of

TABLE No. 1

1 Line No.	2 Item	3 Price per lb.	4 T. P. No. 11	5 T. P. No. 2	6 T. P. No. 8	7 T. P. No. 9
1.	Pounds Fruit Per Palm Shipped		264.94	234.50	225.25	213.50
2.	" A Grade do	.145	9.62	14.25	13.8	5.15
3.	" B-1 " "	.108	73.00	92.94	74.75	65 2
4.	" B-2 " "	.058	145.56	101.06	101.04	110.25
5.	" C " "	.099	24.06	14.37	25.45	23.65
6.	" D " "	.030	4.06	6.37	4.40	3.75
7.	" Culls " "	.005	8.62	5.50	5.45	5 20
8.	Value Fruit Per Palm, 1939-40 Prices		$20.15	$19.57	$18.35	$16.43
9.	No. Functional Leaves Retained Per Palm		98.25	95.25	99.00	94.20
10.	No. Fruits Retained Per Leaf		120.00	117.20	113.20	116.80
11.	Estimated Fruits Per Leaf Palms Can Bear		125	125	125	125
12.	% Load Due to Lay-off year and Drop		96.1	93.8	90.5	93.3
13.	No. Fruits Retained Per Palm		11793	11175	11222	10727
14.	No. Fruits Retained Per Pound		44.4	47.7	49.9	50.25
15.	No. Fruits Per Pound Shipped		33.2	34.4	33.9	33.0
16.	% Fruit Retained Per Palm Shipped		77.2	72.2	68.0	67.4
17.	Calculated Load Per Palm in Pounds at 50 Fruits per lb. and 125 Fruits per Leaf		245.6	238.1	247.5	233.5
18.	% of Calculated Load Shipped		108.0	98.5	90.9	91.4
19.	Average Price Per Pound—Cents		7.58	8.33	8.13	7.67
20.	Year Off-shoots Were Planted		1929	1929	1929	1929
21.	No. Palms from which Data was Gathered		4	4	5	5
22.	No. Palms Per Acre		48.4	48.4	48.4	48.4
23.	Cost per Palm—Includes taxes and all cost of raising fruit delivered to packing plant, but not depreciation—Average of all producing palms		$6.08	$6.08	$6.08	$6.08

Columns Nos. 3 to 5, inclusive, give results obtained in the study of the bearing capacity of the Deglet Noor. Column No. 2 describes the item considered.

fruit delivered to the packing plant.

Line No. 15: Figures on this line were obtained by taking samples of fruit delivered to the packing plant and determining how many there were to a pound Note that the heaviest dates are not on the palms carrying the least dates.

Line No. 16: These figures were calculated from Lines Nos. 14 and 15. The difference between figures shown on Lines Nos. 14 and 15 is the number of fruits lost between the time of thinning and the time the dates were delivered to the packing plant. In 1940 the loss was due mostly to poor pollination and drop. These figures express the percentage of the number of fruits retained on the palm, at the time of thinning, that were delivered to the packing plant.

Line No. 17: Gives the calculated load per palm in pounds, based on the assumption that 125 fruits per leaf retained on a palm, at the time of thinning, will produce 2½ pounds per leaf delivered to the packing plant. This was the basis of estimating the 1940 crop.

Line No. 18: This is a comparison of figures on Lines Nos. 1 and 18. It shows what we got and what we expected to get, expressed in terms of what we expected to get.

Line No. 19: Gives average values per pound based on grades and prices given on Lines Nos. 1 to 7 inclusive. Note that the plots giving the highest prices per pound do not give the greatest value per palm.

Line No. 20: Gives the year the off-shoots were planted. It will be seen that the palms were eleven years old when this data was gathered.

Line No. 21: Gives the number of palms in each plot on which data was taken.

Line No. 22: Gives number of palms per acre of land.

Line No. 23: Gives costs per palm. These figures were taken from Mr Arkell's books for the year 1940. It is not the exact period during which the dates were grown. It includes taxes and all costs of growing dates and delivery to the packing plant, but does not include depreciation. Calculations were made with a slide rule.

Until such time as Mr. Arkell feels justified in changing, he will continue fertilizing as outlined above. This method of thinning is being extended to the remainder of the garden. One change will be made in the thinning practice this year. Ten leaves will be used as the functional value of the "heart leaves" instead of fifteen previously used.

The palm is used as a unit of costs because it is the smallest individual unit that can be observed, as a basis of calculation of profit or loss, in operating a date garden. In making this study, we have been able to apply results obtained by other growers to our methods, and their advice has been used to our profit.

The California Date Growers' Association, and the College of Agriculture have aided in gathering and calculating data.

Ed McIntyre, Bill Cook, Bruce Boyer, Bert Cavanagh, Dr. D. E. Bliss and many others have given both information and advice.

Arthur Cavanagh has worked on most phases of the problems as they have come up.

James Arkell has made the whole thing possible, not only by financing the project, but by discussing and helping to solve the problems that arise.

ECONOMIC RESULTS OF CHANGES IN VOLUME AND QUALITY OF PRODUCTION OF DATES OF THE DEGLET NOOR VARIETY

By Wm. W. Cook

This paper, together with several others, presents the subject of "Securing Higher Date Yields and Improving Quality." To avoid becoming involved in generalities this part of the presentation will be confined to facts, figures, results and the conclusions therefrom derived from eight years recorded operation of a tract of three acres containing 150 Deglet Noor palms, the youngest of which were ten years old in 1933. For the eight year period there has been an average of five palms out of production. Therefore this tract can be considered to consist of three acres with 48 plus bearing palms per acre.

At the present time these palms vary in height from thirty to fifty feet. Portable ladders are used, also safety harnesses when picking and applying covers. It may be noted that the total man hours of labor required has increased 10% during this period due to the increased height of the palms.

This tract is located on the Deep Canyon debris cone. The soil is described as Coachella Fine Sand. In the opinion of qualified date growers this particular plot has ideal soil for Deglet Noor date palms. Drainage is excellent.

There follows a brief description of the soil management practices employed.

The average irrigation is just under six acre inches. From twenty to twenty-three irrigations are made annually, or a total of ten to eleven and a half acre feet per year. The periods between irrigations vary from ten to fourteen days in the summer to as long as six to eight weeks in the winter. Half of the palms are irrigated by the border method, half by furrows. Almost every year a difference in yield and quality on the two halves is noted. Unfortunately these results are not consistant. Over the period as a whole it appears that the border method has produced the best results. However, in two years the furrow irrigated portion produced the heaviest yield, and one year produced a noticeably better quality.

The following fertilizer program has been followed in the main. It must be noted that it was not strictly adhered to through the eight-year period. In general, steer or dairy manure was applied in December or January every two years at the rate of six to eight tons per acre. Ammonia Sulphate at the rate of ten pounds per palm was applied at this time each year. Two years a second application of ten pounds of Ammonia Sulphate was made in July. In the years when no manure was applied there was from ten to twenty-five pounds of Vacatone applied per palm. This is residue from the manufacture of commercial alcohol and contains a good percentage of Potash, some Nitrogen and many minor elements found in the date.

During the last eight years the palms have each had 90 pounds of Ammonia Sulphate, 1,350 pounds of manure and 95 pounds of Vacatone. It is believed that additional fertilizer material could have been applied profitably. The average annual cost per acre was approximately twenty dollars ($20.00).

To summarize the soil management on this tract: Three items are given consideration— (1) To use a minimum amount of water yet not allow the palms to become too dry for even a short period. An intentional error is made on the side of slight over-irrigation on the theory that the application of a little too much water most of the time is inexpensive insurance against serious damage from lack of sufficient water for a short period at some time of the year.

(2) The application of a reasonable amount of fertilizer thereby maintaining the fertility of the soil.

(3) To cultivate only as much as is necessary to avoid noxious weeds getting a foothold. Also to keep the soil clean cultivated during the months of August through September. It is believed that some reduction in humidity under the palms is accomplished by this latter practice.

All of the above factors are important in the production of high yields of good quality dates. Even more important is proper fruit management. Other papers presented this afternoon and at previous Date Institutes discuss details. Suffice it to say here that if pollinating, thinning, bunch support by tying the fruit stem to a frond mid-rib, bagging and picking are not done properly the results will be most unfortunate, despite good soil and the best of attention to soil management. Special mention is made of two items, however. More importance should be attached to proper support for the fruit bunches during the growing period. If the thinning operation is done properly there are no "extra" bunches, and every bunch lost by the breaking of the fruit stalk, every date that is scared by contact with other parts of the palm represents a cash loss to the grower. Also, the application of paper covers for rain protection should be made carefully. Much of the cost of covers is wasted unless they are properly applied and securely tied.

The question may be asked, "What is the basis that should be used in determining the number of dates per bunch, the number of bunches per palm?" No specific rule of thumb can be given. The grower must consider soil, palm condition, leaf area, and watch his results from year to year. These results are shown in volume and quality of production. Date growers have appeared to give too much weight to **quality** and forgotten the importance of **quantity** in many instances. Cost of production, gross income and profit should be measured per palm or per acre rather than per pound, for picking is the only cost that is directly in proportion to pounds harvested, and even picking is often slightly less per pound on heavy producing acreage.

Per pound cost is determined by the quantity produced per acre as much as by the cash expenses per acre.

Gross returns per acre are determined as much by the pounds harvested and packed as by the selling price per unit.

Add these two facts together and it becomes obvious that since **quantity** is a major factor in both of the items that determine cash profit per acre, **quantity of production is the major factor in determining profit or loss for the date grower.**

The grower must therefore determine the annual quantity of dates he should leave on each bunch and on each palm to give him, over a period of years, the largest possible **cash profit per acre.** Some of these points are clearly illustrated in the following table of operating results on the palms described in this paper. All pounds shown are total picked weight. Cents per pound are total dollars divided by total picked weight.

Year	Total lbs. harvested per acre	Gross receipts per acre	‖ Cash cost per acre	Cash profit per acre	Gross receipts per lb.	Cash profit per lb.
1933	16,513	$564.32	$310.71	$253.61	.0342	.0154
1934	6,572	296.14	248.52	48.62	.0451	.0074
1935	14,215	602.95	318.18	248.77	.0424	.0200
1936	13,661	562.50	307.95	254.55	.0412	0186
1937	13,678	763.95	317.36	446.59	.0559	.0327
1938	7,442	511.22	210.73	300.49	.0687	.0404
1939	6,771	193.46	235.24	-41.78	.0286	-.0062
1940	12,457	*635.70	345.75	289.95	.0510	.0233
8 Yr. Av.	11,414	$516.28	$286.81	$229.47	.0452	.0201

* 1940 gross receipts estimated.

‖ Cash cost includes all cash outlays for labor,, water, taxes, materials, supplies, and harvesting. Does not include Management, Depreciation and Interest on investment.

From the above the following is noted:

1. The 1933 production was too heavy, resulting in poor quality and a drop in receipts per pound. More serious was the short crop the following year caused by this overloading of the palms. Note that the increased price per pound the following year nowhere near made up for the crop being 50% short of normal. Pounds picked were reduced 60% while total cost was reduced only 20%.

2. 1935 and 1936 were normal crops for these palms. The next year, 1937, the palms were damaged by extreme cold weather. A normal crop of fair quality was matured, but it was not as good as it should have been compared to the average level of quality in the valley. The palms were somewhat overloaded in view of the loss of leaf area from the freeze. The 1938 crop was thinned too much, representing the other extreme from the 1933 handling. This resulted in a high quality, a large return **per pound.** However, the yield was so reduced that the cash profit per acre was below the previous year. The 1938 low yield is partly due to overproduction the previous year, but the main cause was heavy thinning.

3. The 1939 crop was normal and would have been at least 13,500 pounds had the rains of September not occurred. The low return per picked pound was caused by the high percentage of culls and shrink. The cash loss per acre was caused by the combination of low yield and low returns per pound. This loss was made more severe by the fact that a third of the bunches were not covered at the time of the rain.

4. The higher cost per acre for the last years is caused by somewhat higher hourly wage rates and by the requirements of more man hours due to the increased height of the palms.

5. The Gross Receipts per Picked Pound show both the effect of yearly variations in quality and the effect of a steady gain in the farm value of dates as a whole during the period 1933 through 1940.

From the above it is obvious that three factors effect the cash profit per acre. Returns per pound, pounds per acre, cost per acre. Taking them up in order:

Returns per pound — the grower has two controls over this item; the quality of the dates he produces and his choice of packing and marketing facilities. Poor dates will produce low returns per pound even though packing costs may be less on such fruit. If the quality is better the per pound returns will be better. If the grower's packing cost can be lowered his per pound returns will be improved; provided, the packing house cost is not lowered because of improper handling. If the reduction in cost is accompanied by serious reduction in the grade of his pack out, the grower may find his net returns reduced instead of improved. If he selects an inefficient marketing agency his per pound returns will be reduced. Over a period of years it will be further reduced if his marketing method is harmful to that of the industry as a whole and thereby helps to lower the per pound return of all growers, including his own.

Pounds per Acre—Once the matter of packing and marketing is settled the date grower must get back to consideration of his own palms and the soil in which they are growing. He must decide how far he can profitably cut total production by thinning in an effort to get better quality. Once he has made this decision he must oversee all operations and accomplish the result he has decided is most advantageous for his particular date garden. A wrong decision as to how many dates to leave per palm or per bunch is no more costly than failure to follow through and do the job properly.

Cost per Acre — The grower has certain set costs that can not be changed. He may hold them to a minimum, but that is all that can be done. Other items are optional, and the grower must decide how far he can go in undertaking each of these things and have each of them help to increase his cash profit per acre. If a grower wants to buy esthetic pleasure and groom his palms for parade dress that is his business—but he should do it with his eyes open and weigh its cost as against whatever benefit he will derive. Any item of expense that does not improve the cash profit per acre enough to more than pay for itself is not a legitimate cost for the production of a date crop.

To put it another way: Take the example of a date acre that is expected to produce 10,000 pounds at an average value of five cents per pound. The gross revenue will be $500.00. Assuming a cost of $300.00 the grower will have $200.00 to cover management, depreciation, interest and profit. If he decides to spend an additional twenty-five dollars for fertilizer, extra labor, or additional cultivation he must justify it by an increased production of 500 pounds and will have to plan on picking this extra 500 pounds as a means of exercise or else boost his production another 25 pounds to pay for that additional picking. Or he can justify an additional $25 expense by an increase in the per pound returns of a quarter of a cent. On the other hand, if he omits something and thereby saves twenty-five dollars his saving will result in a loss if he drops his production or his per pound returns more than the above amounts.

If a grower will spend the time to determine the optimum yield per acre, per palm, per bunch and per thread for his date garden; if he will then see that his fruit is handled in a manner to approach this ideal as nearly as possible without spending more than he gains by his extra care; then that grower will get the maximum return out of each date grop. Refer back to the table and the results of good and poor fruit management are clearly shown.

While the 1939 results were not due to poor management they serve to illustrate the point. 1933 plus 1934 clearly shows the result of poor management, with an average cash

profit for the two years of $150.00 when it should have been over two hundred dollars. The table would indicate that the writer learned something the expensive way. It is hoped that this information will be of value to others and that by a study of it other growers may learn the same thing and not have to pay for it at the rate of fifty dollars an acre.

SUMMARY OF THE DATE GROWERS REPORTS

By H. B. Richardson, Assistant County Agent, Riverside County

Mr. Cavanaugh has asked me to make a summary of the six foregoing discussions on the management of date gardens. It is rather difficult to analyze each individual grower's operations and to single out these operations as being the sole reason as to why he is producing a higher or better crop of dates than his neighbors.

It seemed to me as I listened to these discussions that growers have made a great deal of progress in attempting to analyze those practices which enable them to carry on successful date garden management. I take some pride in feeling that the Agricultural Extension Service, University of California and other governmental agencies have helped to point the way for better and more intelligent production methods. The date growers reporting to you this afternoon are some of the outstanding producers in the Coachella Valley and I have talked with the individuals regarding their problems, and am impressed with their knowledge and understanding with which they try to interpret their problems.

Soils, the importance of which was named in each discussion I note also that emphasis was laid on the lighter types of soil. These types are producing some of the best and largest crops of dates. In other words, heavy soils limit the water-taking ability of the plant and past experience has shown that many of Indio and Woodrow types are not satisfactory for date production. We are finding out in the date industry, just as we have found out in many other agricultural enterprises, that there is no substitute for good soils. We have found also that it is impossible to take poor soil and ever make it into an A-number-one soil. This is well illustrated in the citrus industry of Southern California where attempts to raise oranges on poor soil types even with the best of care and attention has not been profitable.

Another item which was discussed in some length by each grower was water. In the hot interior Valley district, water is the life or death of any agricultural crop. The amount of water that the date palm uses is extremely high and as has been reported in this discussion, anything from ten to fifteen acre feet a year being applied. I think, as growers have reported here, that they are impressed by the necessity of applications of ample amounts of water. Some growers are using flooding methods, some are using furrow methods and borders for distribution. I have noted that more and more growers are spreading the water over the surface, thereby allowing a certain amount of leaching to take place. This leaching is very necessary if irrigated agriculture is to survive in these desert areas. It is true that leaching takes away not only salines but nitrates as well. There are bound to be some losses, they can't be helped. It is also indicated that those growers who use the most amount of water in a spreading fashion seem to have a better and more productive garden.

The favorite topic of discussion among many of our farmers and date growers is that of fertilizers. Little factual information is available from research work on the fertilizer requirements of date palms. Our older established industries in which a great amount of experimental evidence is available indicates that nitrogen is the one limiting factor. I note that all growers who report here this afternoon are using barnyard manures and simple nitrates such as ammonium sulfate and often times limited amounts of phosphoric acid and potash. I rather doubt the necessity of applying phosphoric acid and potash where manures have been applied. I have been impressed with many of the trends in fertilizer applications to many of our crops. We know that these crops use a good many more mineral elements than just potash and phosphorus. Most of our soils are capable of supplying these materials. In some soils where manures have been applied over long periods of time, we find that these elements tend to accumulate especially phosphoric acid and potash.

I am of the opinion a fertilizer program for Coachella Valley date soils should include nitrogen first. All the soils which this office has had analyzed from the Valley are high in potash and phosphoric acid. Should the applications of potash and phosphoric acid be necessary barnyard manure can supply the deficiency very satisfactorily and inexpensively. Certainly more careful study and observation are necessary by both growers and research institutions.

The use of cover crops is quite well established. Dr. Aldrich and his staff are carrying on work which will give us more information on the desirability or the undesirability of having cover crops in the date gardens through the late spring and early summer months. It has been pointed out that Hubam clover is largely used by most date growers. Cover cropping is a satisfactory source of organic matter, the use of which can be very helpful on some of the medium to heavy type soils. Cultivation practices vary; some growers keep the soil fairly clean, others allow the weeds to accumulate. We have found that normal cultivation does not materially affect the crop one way or another when properly carried out. As pointed out here this afternoon, when weeds begin to make the handling of irrigation water difficult or begin to compete for moisture with the palms, then it is time these crops be eliminated.

Bunch management was touched on this afternoon as one of the important items in date garden management, however, I believe this subject should be covered at another institute in a similar manner as factors of orchard management have been covered here this afternoon.

All the growers are interested in production. The growers who have reported to you here are producing large crops of fruit. As Mr. Cook has indicated, it costs just as much to take care of a few blank spaces

in an orchard as it does to take care of a solid block. The industry is young, the average age of trees being somewhere around ten or fifteen years old. Problems are going to arise, some will diminish, old ones will be intensified. The way the industry has worked on its difficulties during the last few years, it is my opinion that growers such as those who reported here this afternoon will be in the date growing industry for a good many years.

There is one other factor which I would like to mention before I finish, and that is the personal equation which is highly important in the success or failure in the management of a date garden. The interest that has been shown in these previous institutes and educational meetings is most gratifying. The growers who reported here this afternoon I think are to be complimented on their knowledge and understanding of the problems. As long as discussions such as this may be carried on, we are safe in concluding that the date industry is in very good hands.